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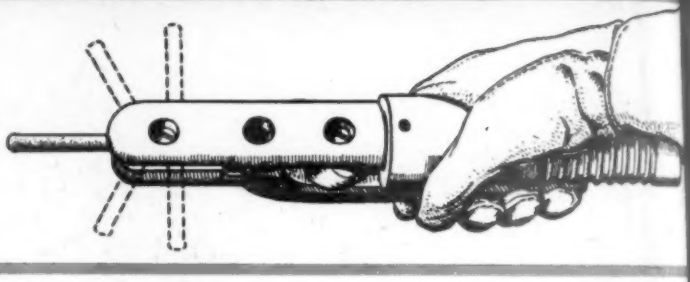

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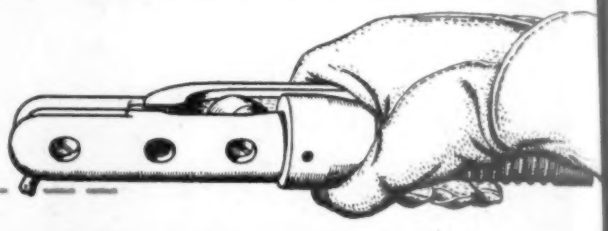

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Fabricated-Welded Valves

When cast and forged valves could not be obtained, the Navy turned to welding as a means of fabricating gate valves, globe valves and swing check valves. What was learned in war will have many uses in times of peace.

By **ERNEST CALIFRO**

Senior Mechanical Engineer,
U. S. Navy Yard, Mare Island, Calif.

DURING the war welding was used extensively as a means of fabricating valves for piping systems in naval craft and also for piping systems in various war plants. This method of producing valves, though somewhat more costly than the conventional casting or forging, was a necessary forward step in view of war-crowded foundry and forging facilities which made it impossible for valve manufacturers to meet the ever increasing demands for their products.

Now that peace is here again, we find that there is still a need for the valve that may be fabricated from plates and assembled by welding. This method of producing valves is ideally suited to those applications where special valves are needed or where only a few valves of a type are to be made. Welded fabrication offers these two important advantages: the cost of expensive patterns is eliminated and the finished product may be obtained in a much shorter period of time.

Cast Steel to Cast-Welded

Due to service demands by the U. S. Navy for higher temperatures and pressures in ship piping systems, a transition from the use of cast nonferrous materials to that of cast alloy steels took place several years before the country entered the war. The rapid progress in the use of radiography as an inspection medium served to enhance the importance of the valves and fittings to be installed aboard naval vessels.

During the period immediately before Pearl Harbor, the Navy set up certain action to investigate casting designs in order to determine why various difficulties were encountered in the production of the finished castings. The resulting collection of data on faulty designs and foundry practices paved the way for the application of cast-welded steel units.

By "cast-welding" is meant a process in which casting is combined with welding. The designs of intricate fittings, manifolds and valves were greatly simplified by casting them in several pieces, which were then welded together and stress relieved as a unit. This process enabled the ultimate sizes of cast valves to be materially reduced, eliminating the need for large heats and difficult molding operations in the foundry.

Fabrication by Welding

Cast-welding was only a transitional phase. In July, 1940, a conference was held in Washington between representatives of the Bureau of Ships, commercial valve manufacturers and some representatives of navy yards to discuss the potentialities of all-fabricated steel valves for use on naval vessels. The reason for this conference was that difficulty was already being experienced in obtaining cast valves and fittings because of the requirements of plants being built for the synthetic rubber program and of the rapidly expanding shipbuilding program for non-naval vessels. Another factor soon to make its importance felt was the shortage of critical materials created by the war.

After Pearl Harbor, the Navy could brook no delays in securing the valves it needed. In many cases where battle-damaged vessels were being repaired, the time required for cast materials proved to be the critical factor in the restoration of the ship to the fighting line. Accordingly, steps were taken at Mare Island to relieve one of the principal bottlenecks by the introduction and more extensive use of fabricated-welded structures.

Fabricated-welded valves, manifolds, strainers, turbine casings, pumps and many other machinery parts are now being manufactured daily. This has not only relieved unnecessary delays but has reduced the weights of machinery by employing inherently stronger rolled materials instead of castings. For example, tin-bronze castings were formerly used on ship's ventilation gate valves; these are now pressed to shape from ⅛ in. sheet steel and welded at a saving of approximately 50% in weight. Another phase of conservation has been to uti-

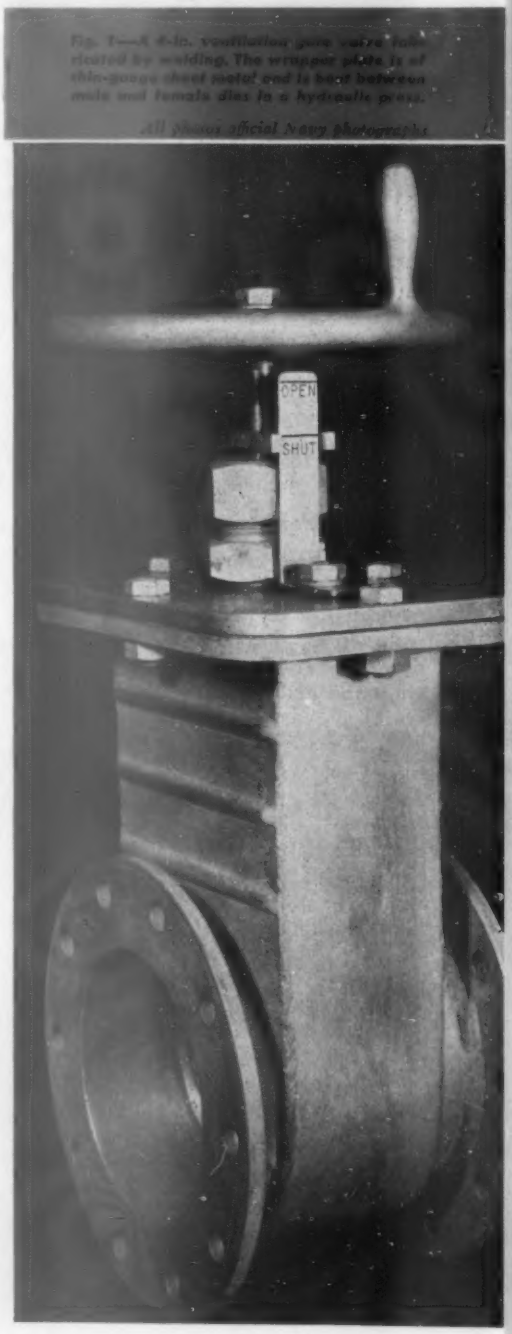


Fig. 1—A 6-in. ventilation gate valve fabricated by welding. The wrapper plate is of thin-gauge sheet metal and is bent between male and female dies in a hydraulic press.

All photos official Navy photographs

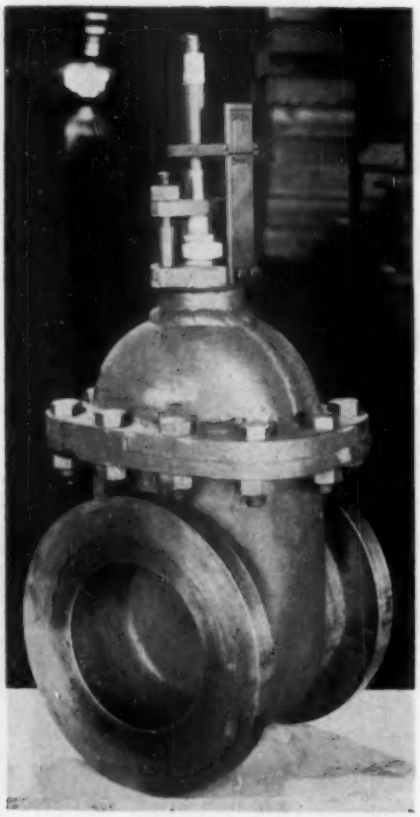


Fig. 2—A 5-in. gate valve designed to withstand a pressure of 150 psi. The body was pressed cold in two halves from steel plate. The rounded body contour greatly increases the strength.

lize scrap steel which would otherwise have been wasted.

Non-Ferrous Valves, Too

A point of interest in the manufacture of valves has been the fabrication of non-ferrous plate materials such as commercial brass, phosphor-bronze, silicon-bronzes, 70-30 (cupro-nickel) alloy and Monel. In the fabrication of 70-30 alloy and Monel valves, which are used in salt-water piping systems, the entire valve is made of the same alloy. Casting these alloys in light sections had been practically impossible, but weld-fabrication allowed the use of light plate material.

Some fabricated steel valves are used in combination oil and salt-water systems. These valves are also combinations. Their stems, discs and seats are of Monel, the steel bodies are hot-dipped galvanized and then redipped in lead.

Additional designs for practically every type of fabricated valve are being developed as a result of the knowledge and experience gained from quantity manufacture.

Making Gate Valves

Several ideas and trends of thought existed on the most economical methods of fabricating gate valves in order to eliminate the cost of expensive dies. The thought was also borne in mind to have all parts made with common shop tools so that the valves could be built in the average small shop. Hence the bodies were designed to allow for straight shearing, and machining was by lathe operations only.

In the ventilation gate valve, Fig. 1, the outside wrapper, a light-gauge sheet, is bent between a male and a female die in an ordinary hydraulic press. The disc guides are aligned in relationship to the wrapper and welded thereto, using a jig to hold the assembly.

The nozzles are cut off at the 5-degree seat angle from standard steel tubing of the required diameter. They are faced with 25-20 stainless-steel weld deposit and then rough machined on the seat faces to $\frac{1}{16}$ in. of the finished dimensions. The body side plates are sheared to shape, while the body flanges are flame-cut with a standard pantograph-type machine.

A special jig is used to drill the nozzle openings of the side plates. A pile of blanks are inserted into a box-like structure and clamped therein by a set screw. A pilot hole is first drilled, using the centering plug on the top of the jig. This plug is then removed, and the hole is drilled full size and countersunk for the weld.

The guide strips are assembled with the wrapper sheet in a jig which has machined slots to hold the strips in order to prevent the guides from curling the assembly as the welds cool off.

All parts of the valve body are accurately and positively aligned with each other by combination use of the assembly jigs. For the welding operation, the nozzles are aligned with each other and with the body side plates. The parts are tack welded while in the jig and then removed for finish welding.

The bonnet plug, stuffing box, packing nut and gland are maintained to the same dimensions for several sizes of valves in order to minimize change-overs in turret-lathe operations.

Cold-Pressed Bodies

Fig. 2 pictures a newly designed valve which was manufactured after the attainment of quantity production. The body was pressed cold in two halves from steel plate, the juncture being along the vertical transverse plane. It will be noted that in the horizontal section the sides of the body have been curved with a generous radius in the corners. This body structure is inherently of far greater strength than a body with flat sides and square corners.

The bonnet and body halves are pressed in one operation and then cut to separate the body and bonnet after the two halves have been welded. The pressing is done with unmachined dies of heat-treated cast iron alloyed with 1.00% molybdenum and 0.50% chromium.

The guide strips for the gate are either inserted between the two body halves with a vee weld on each side or made thicker and used as a chill strip. This method utilizes all outside welds and makes the operations simpler on the smaller sizes.

☆

Fig. 3—A large, heavy gate valve. Fabricated of steel plate, this 15-in. valve was made to withstand a working pressure of 300 psi.

☆

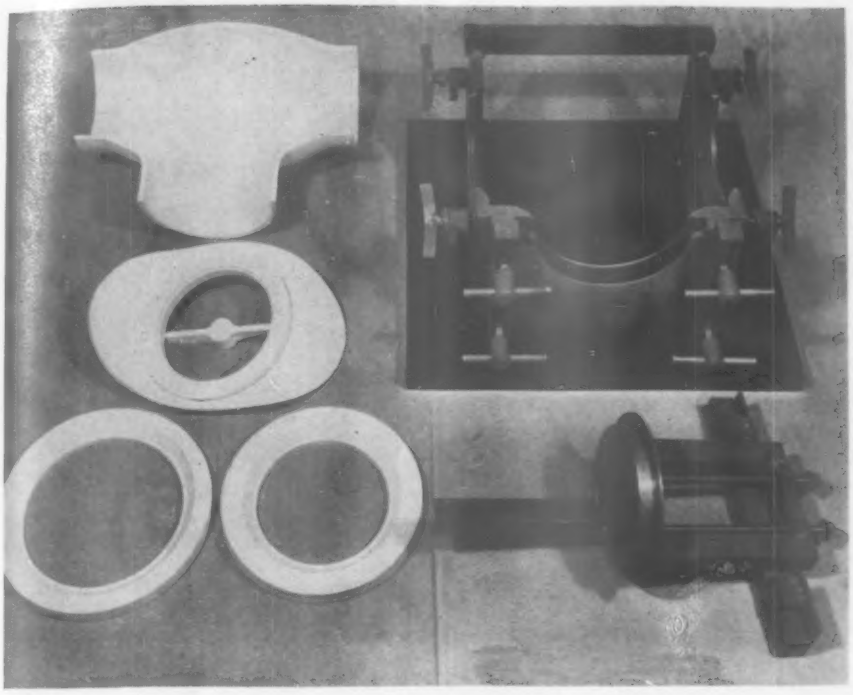


Fig. 4—Parts ready for assembly of a 5-in. globe valve: body half (top), diaphragm (center) and the two nozzle flanges. On the right are two jigs used in assembly; the top jig holds the body and the other the diaphragm.

Monel on Steel

Fabricated gate valves are often coated with plastic of a type which has been extensively used on industrial filters, valves, tanks, pipe lines, etc. This coating has proved entirely satisfactory in many industrial applications, and there is no reason why it should not prove equally satisfactory in marine service.

Monel or bronze seats and gate facings may be deposited on the steel for certain services. A light pass with a pure nickel electrode is used prior to the deposition of the Monel facing The preliminary nickel pass eliminates conditions of porosity which had developed from some types of electrode deposits, most likely because of a high sulphur content in certain pipe materials.

A ¾-in. fabricated steel gate valve is made for service at 600 psi and 750 F. This type of valve has been hydraulically tested to 6,000 psi without developing noticeable stress concentrations. The fact was ascertained by test made while the valve was covered with a coat of stress-indicating paint.

Size is not a factor in gate-valve fabrication. A fabricated steel valve of this type 15 in. in diameter, for operation at 300 psi, is shown in Fig. 3.

Globe and Angle Valves

The bodies of globe and angle valves are made in two halves pressed with simple cast-iron dies. Another type of body is swaged to shape from seamless steel tubing The diaphragm is pressed to shape and cut to a sheet-metal template which fits the inside contour of the body. Prior to assembly, the diaphragm is faced with a 25-20 stainless-steel electrode.

One of the two body halves, the diaphragm and the two nozzle flanges are shown in Fig. 4, which also pictures the two jigs used in assembly. Before welding the two half bodies together, the diaphragm is welded into one body half as shown in Fig. 5. The second half is then assembled, and the circumferential flange and longitudinal seam welds are made from the outside (Fig. 6). The final inside welds are made through the nozzle and bonnet openings. Fig. 7 shows the completed globe valve.

Inside and outside welding is used on steel valves which are to be installed in combination salt-water and oil systems. The total amount of welding, however, may be diminished by

Fig. 5—The diaphragm, held rigidly in position by its special fixture, is welded to one body half. The nozzle flanges are also assembled and welded in this same jig.

Fig. 6—Fabrication is completed by joining the second half body to the diaphragm by inside welds made through the bonnet and nozzle openings. The outside welds are also completed to join the two body halves.

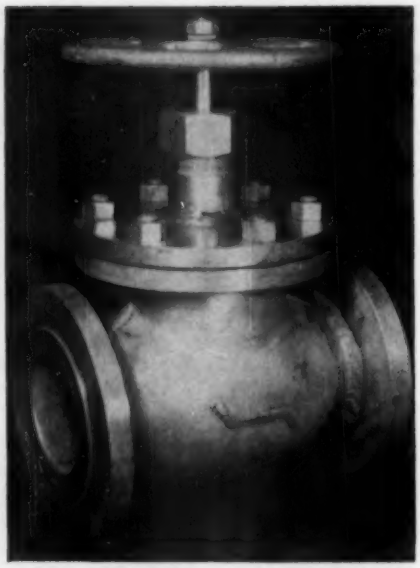


Fig. 7—The completed globe valve. This is a 3-in. welded globe valve of the pressed type.

using only outside welds on the valve bodies. This type of body is pressed in halves, as previously explained, and assembled. The two halves are welded along the longitudinal seam. The body is then cut on a 30-deg angle to the thickness of the diaphragm plate, which is inserted between the two cut halves. This plate forms the backing strip for the weld between the diaphragm and the body. The diaphragm is pressed between two cast-iron die blocks, the outside edges of which form a straight line. The seat is "bumped" 30 deg to this line, forming the surface for the valve seat. A hard-faced deposit (chromium-cobalt) is used on most valve discs to prevent the action of wire drawing.

The swaged type, Fig. 8, is made with a suitable roller die adapted to a Van Stone flanging machine. The same die is used to form the angle and the globe half body. The operation takes approximately 7 minutes and uses a single furnace with two heatings. Assembly is in the same type of jigs used for the pressed valve bodies.

Another type of fabricated angle valve (also made in globes) is particularly adaptable to smaller sizes for which the swaged-pipe or pressed-plate construction is impracticable. A number of bodies are flame-cut in continuous strips from steel plate without waste of material. While still in their strip form, the bodies are partially machined and are then cut off and finish machined. A simplified disc construction eliminates the disc nut and saves machining and weight.

Swing Check Valves

Swing check valves for ¼ to 10-in. sizes have been successfully manufactured. Fig. 9 shows the interior and exterior of a 6-in. check valve. The manufacturing methods and forming of the body shapes are in general the same as those described for globe valves.

Vertical Seating Emphasized

The design feature of vertical seating is emphasized in the construction of swing check valves. Many advantages have been gained by the resulting simplicity of machining. All of the work may be done through the run openings of the valve perpendicular to the centerline axis without the use of special tools or equipment. Tests show that without line pressure these valves may be tilted to an average angle of about 35 degrees before the valve discs leave their seats. This is accomplished by offsetting the hinge pivots of the valve discs. The valve pivot is attached to the inside of the body. This construction allows the cover to be removed for interior examination without disturbing any original adjustments.

A universal welding jig may be used to fabricate various types and sizes of swing check valves.

Facing and Machining

The facing material used on the disc and seat is deposited with a cast-coated electrode composed of chromium, nickel, carbon and iron. Deposits

Fig. 8—A 3-in. angle valve of the swaged type (compare with Fig. 7).

of this facing material have an average hardness of 36-38 Rockwell C. Machining is done by the use of sintered carbide tool bits. Grinding and lapping-in operations have been cut down considerably by using chromium-cobalt hard-facing materials. Tests for impact, salt spray and reaction to organic and mineral acids have all shown excellent results.

The dimensions of swing check valves are in accordance with U. S. Navy standards for valves of 150 psi.

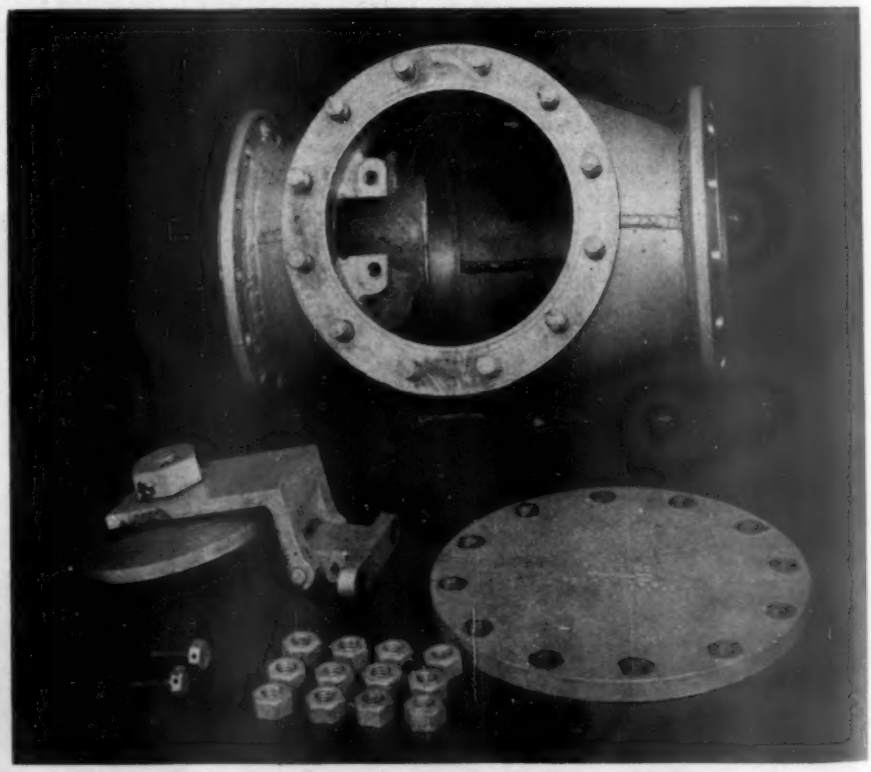
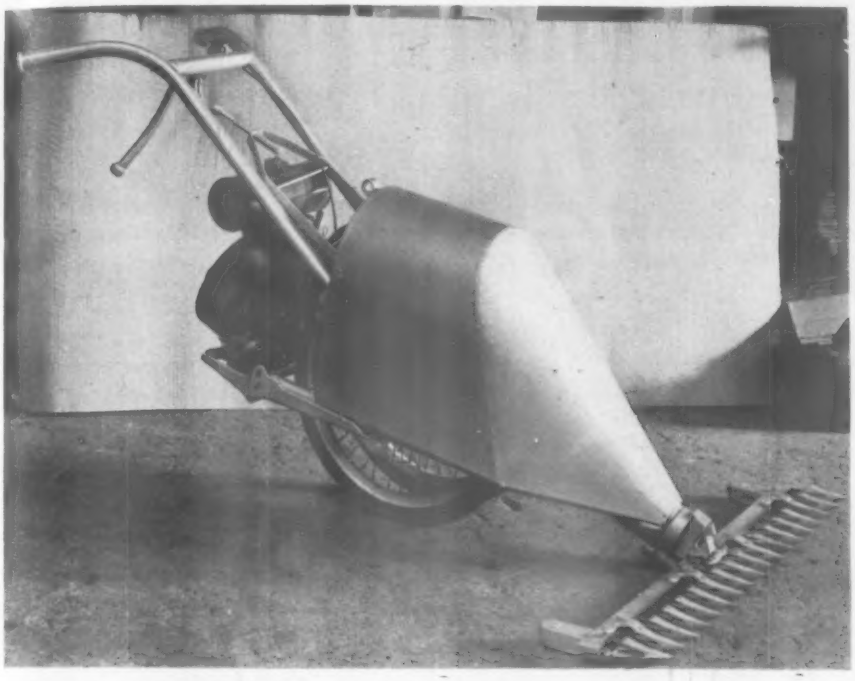


Fig. 9—Exterior and interior of a 6-in. swing check valve fabricated by welding plate steel.

★ PRODUCTION

Welded Shaft Mounting

A cost saving of about 45%, a weight saving of 23% were effected by turning to welded fabrication for the power shaft mounting of an engine-driven scythe.



Photos courtesy, The Lincoln Electric Co.

Fig. 1—The completed scythe. The cast power shaft mounting was changed over to welding at substantial savings.

WHEN it became impossible to obtain castings from foundry sources, Jari Products, Inc., Minneapolis, was forced to turn to welded construction for the lower power shaft mounting of a gasoline-engine-driven scythe. The complete unit, illustrated in Fig. 1, is said to be the most efficient mower of its type for service on highways, farms, parks or private estates.

The main frame of this machine was originally and still is constructed of welded tubing. Previously, the power shaft mounting had been made of cast steel; the intricacy of this design had caused a large amount of rejects and consequent high scrappage rate.

Fabrication Not Difficult

Fabrication of the new welded mountings (right in Fig. 2) proved to be a much simpler engineering job than originally supposed. The central part of the structure is a 6-in. piece of standard 1¾-in. tubing; bottom and end pieces consist of ⅜-in. plate, cut and formed to requirements. The individual parts are placed in a positioning jig, tack welded, then finish welded with a continuous bead.

AWS E-6012 electrodes, $\frac{5}{32}$ in. diam, are used to fillet weld the tube to the end plate sections. This is done in a single pass. The plate sections themselves are fillet welded in two passes, using ⅛-in., mild-steel E-6010 and E-6011 electrodes. Effective penetration of the joints is obtained by allowing gaps of approximately $\frac{3}{32}$ in. at all seams.

From $1.19 to 65c

The shaft mountings of the welded design are produced, finish machined, at a cost of 65c each and weigh 2½ lb. The former cast mountings had cost about $1.19 each and weighed 3¼ lb. The saving in cost is approximately 45%, the weight saving 23%.

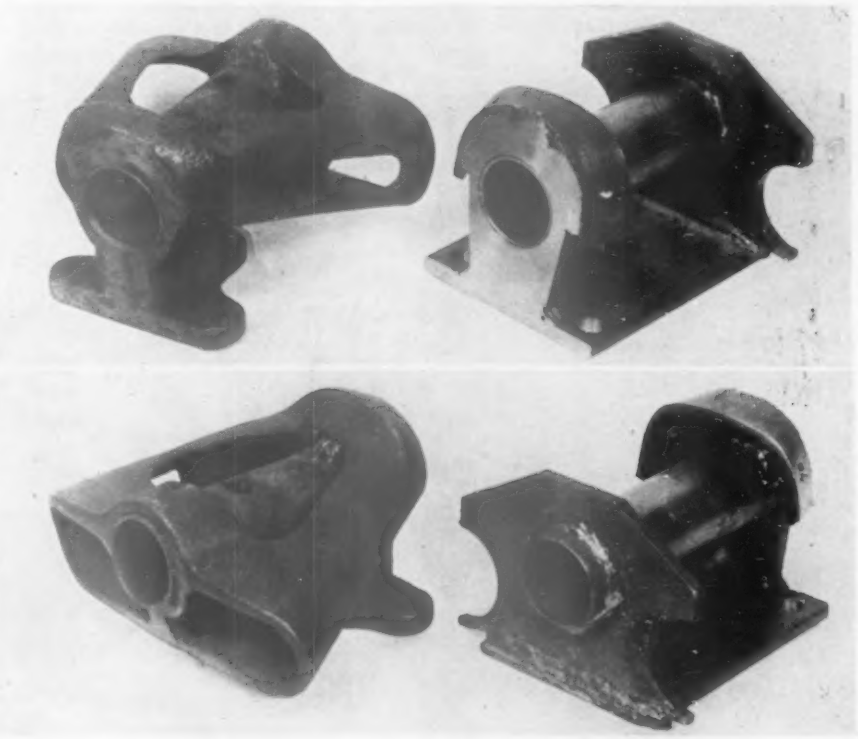


Fig. 2—Two views of the cast shaft mounting (left) and of the newly designed part of welded construction (right).

★ MAINTENANCE

Parts Salvaged by Metallizing

★Part One – Metallizing in a welding fabrication shop is the theme of a new article by Mr. Brooking. We will publish it in two installments: the present one tells how metallizing can salvage worn or mismachined parts.

By **WALTER J. BROOKING**
Director of Testing and Research, R. G. LeTourneau, Inc., Peoria, Ill.

THE use of metal spraying or metallizing in the Peoria plant of R. G. LeTourneau organization was begun approximately ten years ago. Among the early uses was in connection with an experimental prefabricated steel housing project (Fig. 1). A zinc coating was sprayed over the surface of the steel to protect it from corrosion. The metal spray was applied to the outside surfaces of the prefabricated steel house after a thorough cleaning and sandblasting. A reasonable degree of success was attained.

Additional uses were found in the reclamation of a small amount of mismachined parts, a few especially adapted maintenance jobs and some special applications such as an open water trough for the cooling system of a series of twelve Diesel engines. The inside surfaces of the trough were sprayed with zinc to prevent them from becoming corroded through the action of the hot water, which contained especially corrosive elements.

The company's main product is heavy arc-welded earth-moving equipment. Between fifty and sixty thousand tons of steel are consumed each year and somewhat over two million pounds of welding electrodes. As is characteristic of heavy machine arc-welded manufacture, most of the parts are fabricated from steel. The moving parts involved require machining to moderately close tolerances.

Wartime Requirements

Shortly after 1940, when the beginning of the war began to reflect itself in the plant's production, the use of metal spraying increased somewhat. When the United States entered the war, the entire production of the LeTourneau company's earth-moving equipment was taken up by the armed forces, and demands were made upon the organization for larger quantities of equipment than had ever previously been made.

In keeping with the military requirements, the number of moving parts produced in the plant was greatly increased. Along with this upward trend, unskilled and inexperienced workmen replaced many of the young-

Fig. 1—One of the earliest uses for metallizing at R. G. LeTourneau was to apply a zinc coating on this 40-ton prefabricated steel house to protect it from corrosion. Here the house is about half metal sprayed.

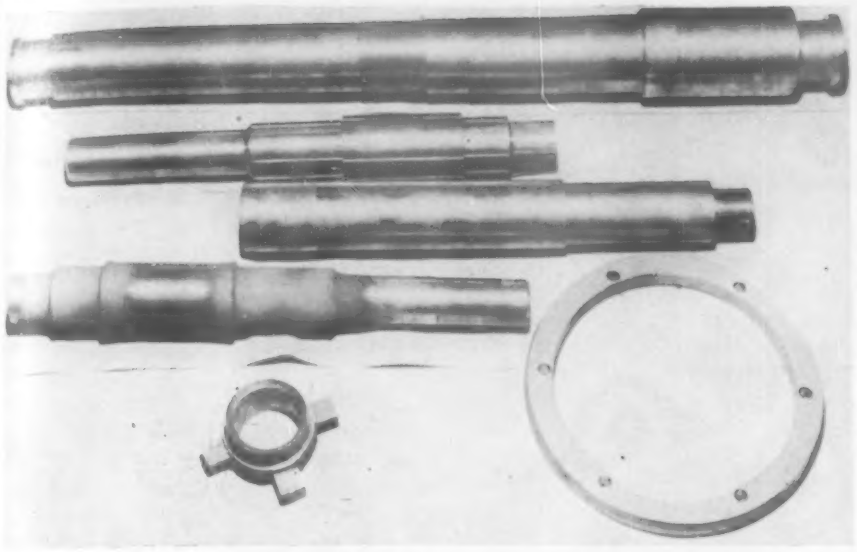


Fig. 2—When parts such as these are mismachined, an important percentage of them can be salvaged by metal spraying such portions as oil-seal or bearing-cup seats and bosses.

er skilled employees who went to the armed forces. The natural result of their inexperience was an increasing quantity of mismachined parts. Some of these parts, however, could be salvaged by using metal spraying to build up the spoiled surfaces for remachining.

Material Shortages, Too

During the same time a critical condition was developing in the supply of steel. It became not only patriotic but almost absolutely essential to salvage every piece of steel which could be salvaged into a usable part.

Metal spraying lent itself to the reclamation and salvage of certain types of parts produced in the manufacture of earth-moving equipment, some of which are shown in Fig. 2. These parts include axles, bushings and wheel hubs, and shafts upon which bearing seats and oil-seal seats were machined. The axles and shafts were especially important because of their size and therefore the amount of steel they contained. They range from short stub axles to large 57-in., 225-lb axles. Either two or four of the latter were used on each of hundreds of scrapers produced each month.

While inexperienced help and a steel shortage were making it essential to salvage all production parts in any way possible, the well-known machine tool shortage arose, coupled with the equally grave problem of getting replacement parts for the maintenance of machine tools. The effect of these twin complications was to cause the use of metal spraying for maintenance and repair to increase still further.

Early in the war and to an ever increasing extent, the metallizing process was used wherever it lent itself most satisfactorily to this salvaging and maintenance program. Often repairs were made which were more expensive than they should have been. With delivery dates for replacement parts running sometimes as high as 90 to 150 days in the future, however, it became necessary to salvage at any cost.

Present Uses of Metallizing

The metallizing process lends itself to the repair and reclamation of many parts in the regular maintenance operations of a large plant equipped with machine tools, electrical equipment, transportation equipment and metal-working machinery.

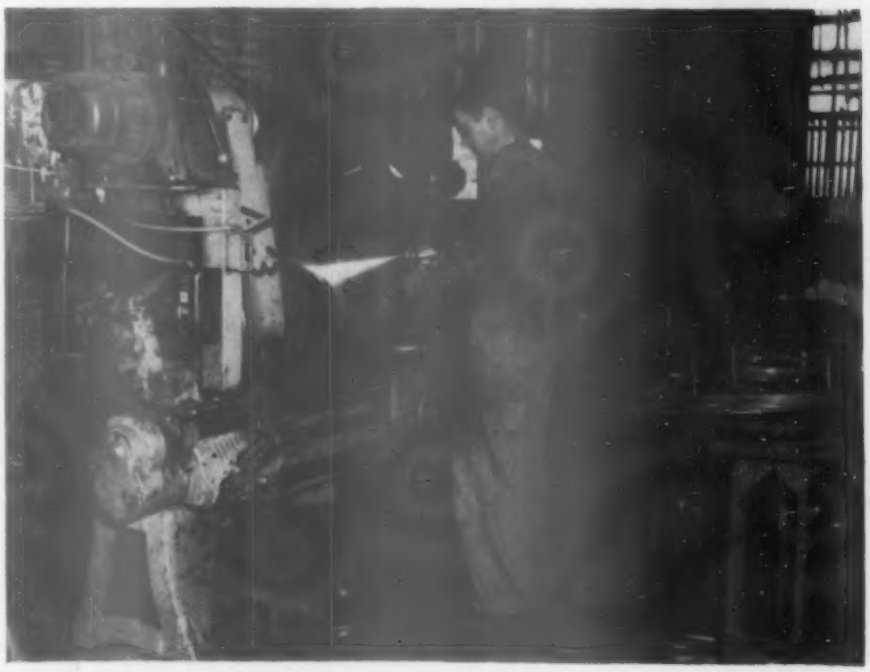
Many worn parts made of cast iron, aluminum or steel (either heat treated or not) may be reclaimed by metal spraying. The fact that the repair can be made within the plant makes the process a valuable tool for reducing down time on vital machines.

The metal-spraying process is used regularly in the salvage of some mismachined parts of certain types at the present time, and R. G. LeTourneau is called upon to salvage, repair and rebuild parts for maintenance of the plant's manufacturing facilities.

The salvage of regular production parts is largely confined to axles (the company produces some forty to fifty types and sizes), clutch cones, hubs, bushings and shafts upon which bearing-cup seats and oil-seal seats are machined to close tolerances. The number of mismachined parts is not large, and not all of them can be repaired by metal spraying.

Prior to the development of electric bonding, metallizing was not used extensively by this organization for the repair of flat or inside diameter surfaces, because of the difficulty of getting the sprayed material to bond with large and heavy flat surfaces and inside diameters of steel parts. The electric-bonding unit makes possible the metal spraying of inside diameters and flat surfaces on steel and narrow

Fig. 3—The metal-spraying outfit includes an engine lathe equipped with a special fume exhauster, spray gun, oxygen and fuel-gas cylinders, air-line connection and wire reel stand. An electric bonding unit completes the department's equipment.



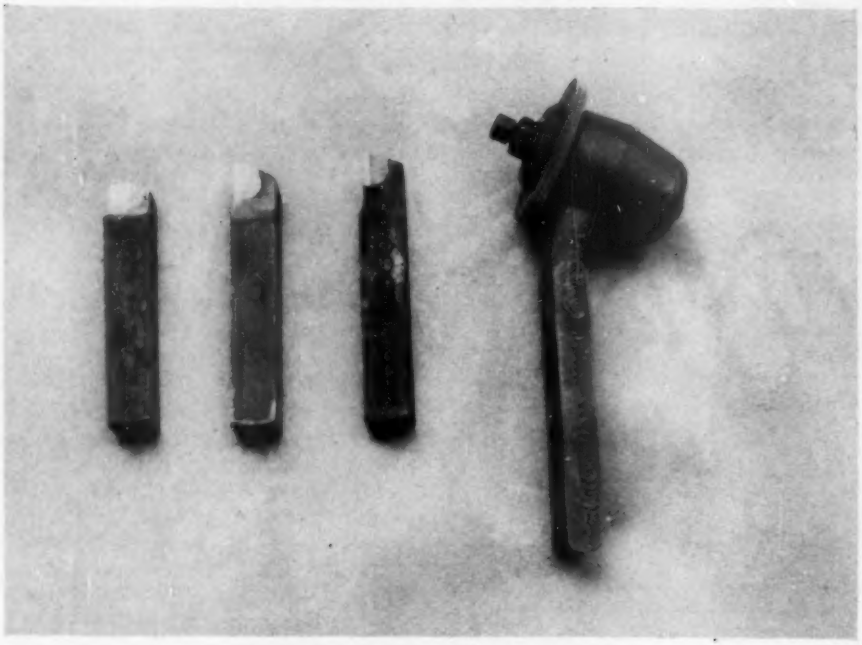


Fig. 4—These carbide-tipped tools are used to finish machine the sprayed surfaces. The special knurling tool (right) is employed to roughen the surface to be sprayed.

bosses which cannot be threaded very satisfactorily. It has, therefore, greatly increased the variety of parts which can effectively be metallized.

Parts and Materials

The parts which are commonly metal sprayed in the repair and maintenance of the manufacturing facilities are:

- Lathe spindles
- Pump shafts
- Armature shafts
- Grinder spindles
- Bearing cup seats
- Bushings
- Gear hubs
- Axles
- Pressed-fit sleeves for shafts or bearing cups
- Non-ferrous linings for containers

The materials upon which sprayed metal deposits may be made are somewhat varied. The most important are:

- Cast steel
- Cast iron
- Hot-rolled steel plate
- Fabricated or forged steel parts of:
  - Mild steel
  - Medium-carbon steel
  - Low-alloy, high-tensile steel heat treated (hardened)
  - Carbon steel
  - Carburized steel (heat treated and not)
- Aluminum castings
- Aluminum parts from bar stock and shapes

The different types of wire used in the spray gun or in the electric bonder to repair the above list of materials include:

- 0.10% carbon steel
- 0.25% carbon steel
- 0.80% carbon steel
- 1.20% carbon steel
- Stainless steel
- Nickel
- Zinc
- Lead
- Aluminum
- Copper
- Brass
- Bronze

Spraying Equipment

An engine lathe large enough to accommodate the variety of parts which are salvaged in this shop is an important part of the metal-spraying department's equipment. This (Fig. 3) is a geared-head lathe, and it is in sufficiently good repair to allow machining to within 0.001 in. tolerances.

A fume gathering and exhausting unit is mounted on the lathe carriage. This collects the fumes arising from the metal spraying and exhausts them away from the operator.

The variety of materials and types of work done in this department necessitates a suitable assortment of lathe tools for turning, threading, facing and boring. When needed, special tools are always available at the tool crib.

Because much of the sprayed material is of high hardness, carbide-tipped tools are generally used to machine the sprayed surfaces. Some of the most common tools are shown in Fig. 4. These are stocked in sufficient numbers so that a regular toolroom service for grinding and repair can be carried out without interrupting salvage operations.

The metal-spraying system itself consists of the spray head, a propane cylinder, an oxygen cylinder, a source of air from the plant's regular air-compressor line and a special air scrubbing and drying unit so that the air supplied to the spraying system will always be clean and dry.

A wire reel stand, a supply of the different types of wire used, a means of storing them in an orderly and clean fashion, goggles, lighting tips, pressure-reduction manifolds and meters for the oxygen, propane and air complete the spraying equipment.

Electric-Bonding Unit

An electric bonder (Fig. 5) is used in conjunction with the spraying outfit for salvage of certain types of parts. It consists basically of a transformer, electrical ground and a cable leading to the bonding head. The operator holds the head in his hand and applies the wire to the surface of the part by low-current arcing from the nickel electrode in the holder. The application is in much the same manner as if he were writing on the surface with a pencil. An air blast is used to cool the head and the work during the electrical bonding process. The air hose is fastened on so that the air will blow around the base of the electrode.

An indispensable part of the department's equipment is a set of micrometers and calipers for measuring any of the variety of parts which are being rebuilt. Go, no-go gauges, snap gauges and plug gauges can be made for routine salvaging operations upon the same part if the number of parts justifies their use.

Seven Production Steps

The process of salvage by metal spraying usually consists of seven individual steps. These are, respectively, cleaning, wire set-up, placing the work in alignment, machining to undersize, rough surfacing, metal spraying and machining to specifications. Each of these steps will be briefly discussed in the present article or in the second installment next month.

The first step, preliminary cleaning of the part, is especially necessary if it is a repair part brought in by the maintenance department. All grease, dirt, foreign materials and especially oil, which might seep onto or get smeared onto the surface being metal-

Fig. 5 — The electric bonder consists of transformer, ground cable and bonding head. The lead and air hose for the bonding head are shown coiled around the oxygen cylinder, but neither of them is connected to the latter cylinder.

lized, must be removed. This can usually be accomplished by washing the part with a petroleum solvent, sometimes by wiping. In extreme cases, sandblasting is used if the part will not be damaged by it. The preliminary cleaning is rather important because any oil on the surface of a part being sprayed will ruin the entire operation.

The second step is to examine the part to determine the wire to be applied to make the repair. Low or medium carbon steel (0.10 or 0.25% C) is normally used for most steel parts unless they are heat-treated and require a very hard deposit. In the latter case, 0.80% C wire is occasionally used but more often 1.20% C wire or stainless steels are used.

The correct wire for the operation is threaded into the gun and placed on the reel stand. Gas pressures are adjusted. Normally, from 25 to 35 psi are used on the propane, 25 to 45 psi on the oxygen and 60 to 90 psi on the air. Lesser pressures are required for spraying non-ferrous materials such as copper, brass or bronze because less heat is required to melt the wire.

Alignment and Undercutting

The third step is to place the part in the lathe and adjust it to the proper alignment for facing and boring operations. This is very important since the metal to be replaced by spraying must bear a closely measured relationship of concentricity to centers, faces, bolt holes, etc. Both the face and the bore of the friction cone shown in Fig. 6, for example, must be perfectly in line before the OD or ID of the boss can be built up by spraying.

The centering and lining up process in the lathe is frequently one of the most expensive in the entire operation because of the need for careful adjustment to bring both vertical and horizontal axles into exactly the right relationship so that the finished machining will be correctly and accurately done.

Undercutting or machining undersize to 0.050 or 0.060 in. is the fourth operation performed on the surfaces to be metal sprayed. If the electric bonder is to be used, 0.070 to 0.080 in. should be removed since the bonding unit will apply an irregular layer of nickel from 0.010 to 0.020 in. thick in order to produce a satisfactory bonding job.

Bonding Methods

After undercutting, it is necessary to provide a roughened or bonded surface upon which the metal spray will be deposited. The roughening operation, step six, is very important to the successful spraying of ferrous materials, both cast iron and steel. There are several methods which may be used: knurling or threading, grit blasting and electric bonding. Electric bonding is usually the most satisfactory, while knurling, threading and grit blasting follow in successive degrees of desirability. Knurling and threading are usually less expensive on relatively large surfaces and are often entirely satisfactory. When non-ferrous materials are to be sprayed onto steel, a heavy grit blast is sometimes satisfactory; for example, the lining of a steel-plate tank with lead or zinc.

NEXT MONTH Mr. Brooking will cover the details of electric bonding and the spraying and finish-machining operations (steps six and seven) in the salvage process. He will also discuss the economics of metal spraying as a repair and maintenance tool.—The Editors.

Fig. 6—This friction cone must be perfectly aligned in the lathe before any machining for metal spraying can be done.

★ PRODUCTION

Heat for Silver Brazing

The principles and practices of induction heating have been well discussed, but the new gas-air burners for silver brazing are less familiar. Their costs compare favorably with induction heaters, states this author.

By **PAUL F. BERG**
Development Engineer, Selas Corp. of America

THE wide-scale acceptance of the silver alloys by industrial designers for fabrication of ordnance and now peacetime products has been influenced largely by the development of new heating techniques lending themselves to low-cost, high-speed assembly. Investments in both electric induction and gas-air heating equipment for such purposes during the war period unquestionably ran into millions of dollars. Now the time is appropriate for a close evaluation of the relative attributes of the two systems.

Induction vs. Gas-Air Heating

Possibly the widest, most dramatic publicity has been given to induction heating, despite the fact that gas-air combustion methods and equipment equally as revolutionary as induction processes have been developed. It is the purpose of this article to discuss briefly such advances and their applications and to compare open-flame gas-air operations with induction heating insofar as shop practices and equipment selection are concerned. No mention will be made of older, more familiar heating methods such as the oxy-acetylene torch or the electric furnace.

Comprehensive descriptions of recently developed gas-air combustion equipment have been published.* The basic variation from conventional gas-air heating apparatus is that the technique employs total premixture of the gas and air from a combustion controller which delivers at relatively high pressures. In applying such a mixture, heat is transmitted to the work by one of three burner types or modifications thereof.

Superheat Combustion

The basic purpose behind the first type — superheat combustion — is to confine the combustion reaction within a small insulating refractory chamber with a restricted outlet opening. The effect is to develop such intense incandescence closely about and around the burning gases that the combustion reaction is greatly accelerated. Tremendous quantities of heat can be liberated within very small spaces (50,000,000 Btu per cu ft of combustion space per hour), and any diluting cold secondary air is excluded from the reaction. This typical burner construction is indicated in Fig. 1.

The second type—radiant combustion—is similar to the compacted combustion of the superheat in that highly insulating and refractory molded ceramic burner parts achieve brilliant incandescence It differs from the first method, however, in that the radiant energy thus developed is directed at the work, and no special effort is made to confine the combustion to the smallest possible space. The entire reaction between the fuel and the combustion air proceeds on the surface of the incandescent ceramic cup rather than in a free flame of the usual nature. Fig. 2 typifies this construction.

Ceramic Screen Combustion

The third type of burner is a development of the traditional drilled metal-plate type. No attempt is made to compact the combustion nor to transform the heat liberated into radiant heat. Numerous ingenious methods of assembling ceramic-screen port systems for various process heating purposes have been devised. Slotted lamina of ceramic are stacked to form ports between adjacent lamina, or ceramic discs are pressed around needles in the die before firing, and so on. Burners of this type (but without the refinements contributed by the ceramic port screen) have been used for some time, but the method should be reconsidered as part of a system employing a combustion controller supplying premixed gas and air. Flexibilities and heating effects previously unobtainable are made possible by this method.

In discussing equipment application, we must, first of all, accept the premise that no one heating device is an absolute cure-all for all heating problems—and particularly that no one heating device or method is the answer to all silver-brazing problems. Unquestionably, numerous equipment misapplications were made in haste or for expediency during the war period.

Criteria for Equipment Selection

The logical criteria for selection of equipment would seem to include the following:

(1) Work quality
(2) Work quantity
(3) Flexibility of equipment
(4) Operating labor cost
(5) Energy cost
(6) Initial cost
(7) Maintenance

In connection with the first point, work quality, we are concerned first of all with securing an adequate joint and, to a lesser degree, with minimum oxidation and cleaning costs. Minimization of the heated zone for maintenance of physical properties and/or distortion control is also significant in many instances.

The attainment of an adequate joint in silver-brazing work necessitates adequate cleansing and fluxing of the members being joined. The temperature of the pieces being joined and of the alloy itself must then be raised to a temperature slightly above the flow point of the alloy. Given proper distribution of heat energy, this result can readily be attained by

* *Industrial Gas*, January 1945, page 9. *Iron Age*, September 23, 1943, page 38.

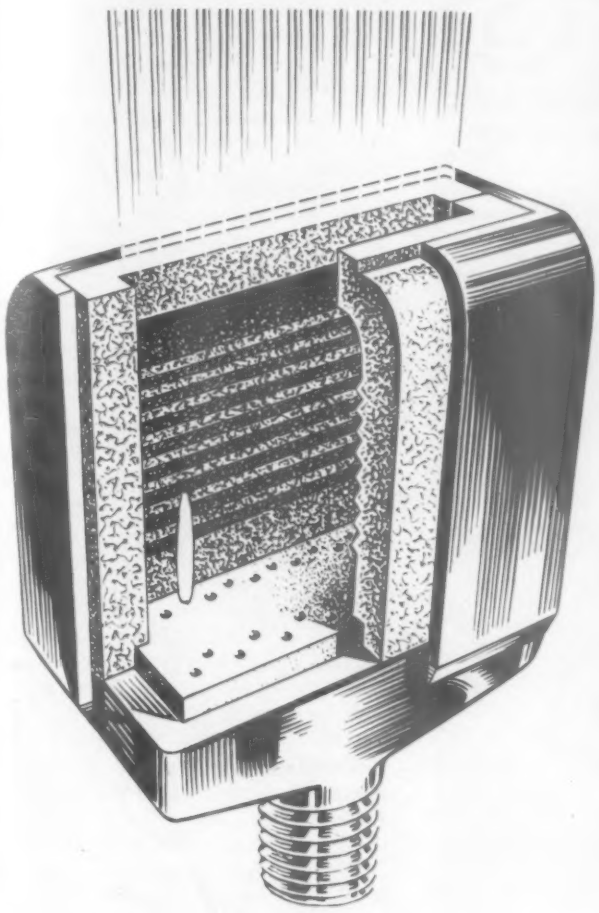


Fig. 1—The superheat burner is characterized by numerous hard flames deep inside a refractory cell to bring the cell lining to white heat. Thus the combustion reaction is almost totally enclosed—and markedly accelerated.

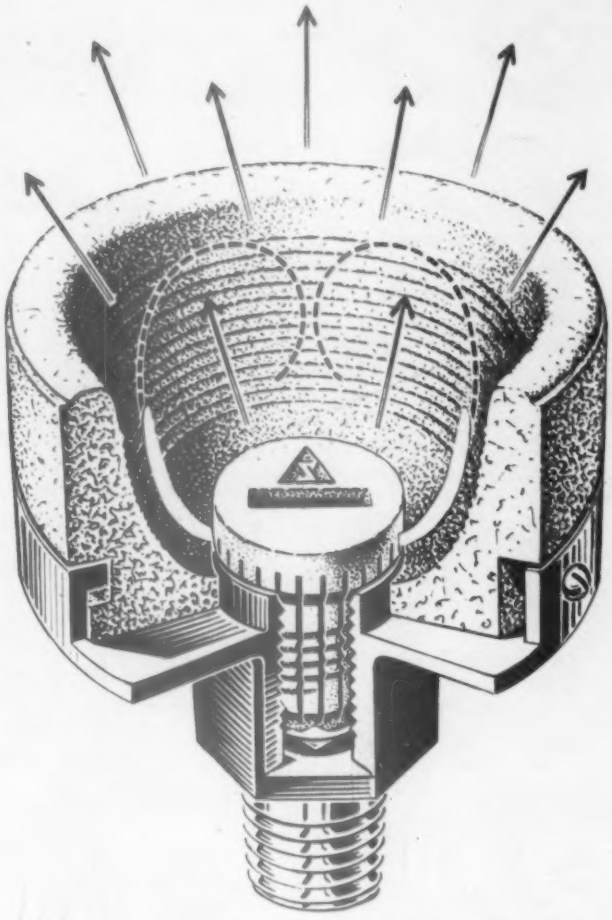


Fig. 2—In the radiant type of burner, a premixture of gas and air under pressure is discharged laterally from numerous slots in a ceramic plug at the base of an insulating concavity. Thus a radial family of flames brings the cup wall to brilliant incandescence.

either induction or gas-air energy. Under the pressure of wartime production, rejects of material were reported due to too rapid heating. Too rapid heating—by any method—does not permit adequate time for alloy flow, a condition resulting in pinhole joints.

Longer Heat Soaking

Even with the gas-air equipment described above, it is not possible to obtain the heating speeds of the higher frequency induction units. Power concentrations in the two cases are of the order of 300 Btu per minute per sq in. of area and 5,000 Btu per minute per sq in., respectively. The relatively low power input in the case of gas-air heating has its advantage. Because of the longer heat soaking period, no rejects due to overrapid heating have been reported, at least not to the writer's knowledge.

Inasmuch as oxidation is a time-temperature effect, the advantage in this particular case is in favor of induction heating. Even with the somewhat greater time cycle of gas-air heating, however, the oxidation problem is rarely a critical one.

Shape and Size Considerations

Work quantity and flexibility of equipment are governed by geometry-size factors. Since the geometry (shape) and size of a piece of work establish whether an induction device should be of the motor-generator or electronic type, it is obvious that there are certain restrictions placed upon the flexibility of induction equipment. The fields of usefulness for the two types of equipment have been generally defined. It is recommended that: (1) larger masses should be heated at relatively low power concentrations (motor-generator sets) and (2) smaller masses at higher power concentrations and frequencies (electronic sets). The above, then, is the fundamental limitation for induction equipment insofar as flexibility is concerned.

Another thought should be predominant in the minds of those governing the selection of induction equipment; namely, is the volume of work processed great enough and similar enough in geometry and size to maintain the unit's operation on a substantially constant basis in order to amortize the equipment cost within a reasonable period of time?

With gas-air equipment, the geometry-size factor is not a critical one. The combustion controller represents the main cost item, and it will be the same (except for capacity) for all silver-brazing requirements. The most frequent change required would be a repositioning of the burner (analogous to a coil change with induction equipment). The geometry-size factor otherwise might effect a simple change in burner type and/or number. The system therefore provides a maximum flexibility, is adaptable for great or

small production requirements and is not influenced by geometry or size. Amortization possibilities within a short period of time for general processing work are thus clearly in favor of gas-air.

Labor and Energy Costs

As in all processing, those charged with the responsibility of equipment selection must consider labor costs. A perusal of current literature reveals that the most prevalent induction installation is, essentially, a heating station where one or more workpieces are inserted and removed manually into and out of the heating coil. Each station or machine requires the fulltime attention of at least one operator. Gas-air equipment manufacturers, less influenced by geometry-size limitations, have reduced labor costs to a minimum by supplementing the energy system with mechanical, continuous work-movement means. Figs. 3 and 4 indicate this method of reducing labor costs.

Prudence should provoke caution in a discussion of comparative energy and equipment costs for specific cases. The writer's data are limited to comparative costs for a few specific pieces of work. Certainly, however, the advantage is greatly in favor of gas-air. The following comparisons may be helpful to those charged with the duty of applying sound managerial and engineering principles in equipment selection:

Case I: The silver brazing of multiple joints in a steel tubular assembly.

Equipment	Energy Cost	Initial Investment for Same Production
Induction	5.0c	$113,000
Gas-Air	0.7c	$ 5,000

Case II: The silver brazing of a steel tubular Army ordnance piece.

Equipment	Energy Cost per 1,000 pieces
Induction	$10.00
Gas-Air	0.54

Maintenance Comparisons

Maintenance costs of induction and gas-air equipment must be considered as cautiously as initial and operating expenses. Generally speaking, however, in the case of either type of equipment in a small (single unit) installation, the most frequent failures (tube, condensers, coil or burner) can be remedied by replacement by plant personnel. In multiple-unit or very large installations, gas-air equipment can still be adequately maintained by shop mechanics, whereas a trained engineer would be desirable to handle more complex failures with induction equipment.

J. P. Jordan† reports that maintenance costs are definitely higher for radio-frequency units than for motor-generator sets. Maintenance of radio-frequency sets averages from 10 to 50c per hour, depending on the tube complements and ratings.

The greatest maintenance cost of gas-air equipment is for burners, and it is questionable if this cost has ever exceeded one or two cents per hour for the average brazing installation.

Since 1941 managing and engineering staffs in most plants have reached decisions relating to equipment selection and fabrication methods under duress from one source or another. The main consideration was seldom cost but rapid delivery to the armed forces. Obviously, it would be bad practice to carry this concept over into peacetime economy. A new view must be accepted—an industrial economy conforming more closely to our pre-war standards.

To survive increasingly competitive markets, industry must again revert to the methods which yield quality products at the lowest unit cost. Wartime fabrication techniques have clearly indicated the advantages of employing assembly by silver brazing to replace more expensive production methods. Equally as clearly, wartime experience indicates that great differentials in unit cost can be directly attributed to equipment misapplication. Engineers and management must appreciate this fallacy and realize that the day of reckoning is here in the revival of a stabilized peacetime economy.

† *Metals & Alloys*, May, 1944, page 1153.

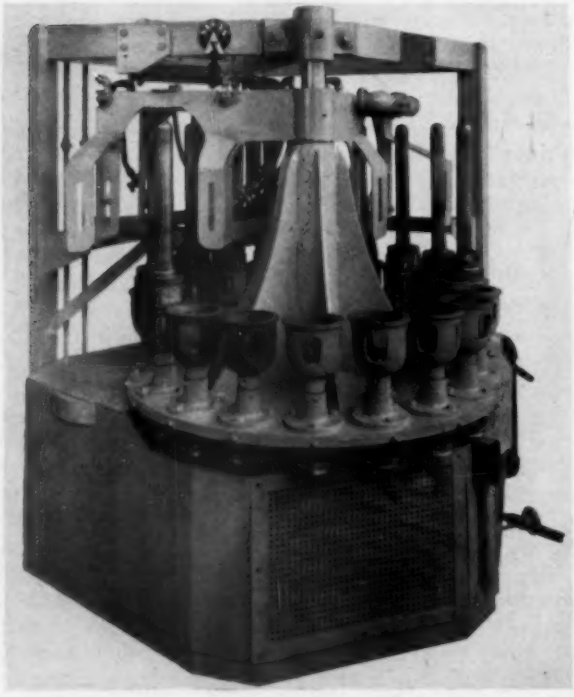
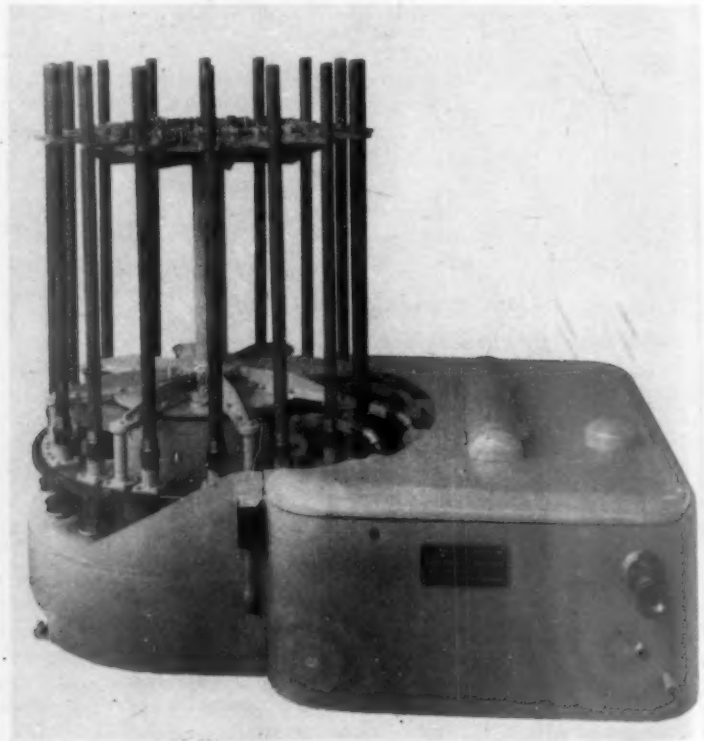


Fig. 3—In this machine set-up, the parts to be brazed are set in cups on a turntable and gradually revolved under the heating flames. The assembled pieces are placed in the cups on the right, while the brazed articles are removed at the left.

Fig. 4—Gas-air heating equipment used for the production silver brazing of fittings to tubing.



★ DESIGN

Elements of Welded Design*

By GEORGE L. SNYDER

Chief Engineer and Assistant to General Manager, Lukenweld, Inc.

★Part Two – This two-part discussion of basic design considerations for welded machinery frames takes up such factors as treatment of intersections, warpage, when to stress relieve, dynamic vs. static loading.

Last month Mr. Snyder discussed the different types of the components available to the designer of machine parts and the methods of producing them: shearing, flame-cutting, blanking, press bending, flanging, casting, forging, etc. Subassembly considerations were also covered, including the all-important question of access. In the present and final installment, he continues with other knotty problems the designer must face such as the best position of joints in weldments, treatment of spoked or diagonal members, welded intersections subject to high stress levels, fatigue and impact considerations, shrinkage and warpage control, external and internal contours of parts subjected to dynamic loading.—THE EDITORS.

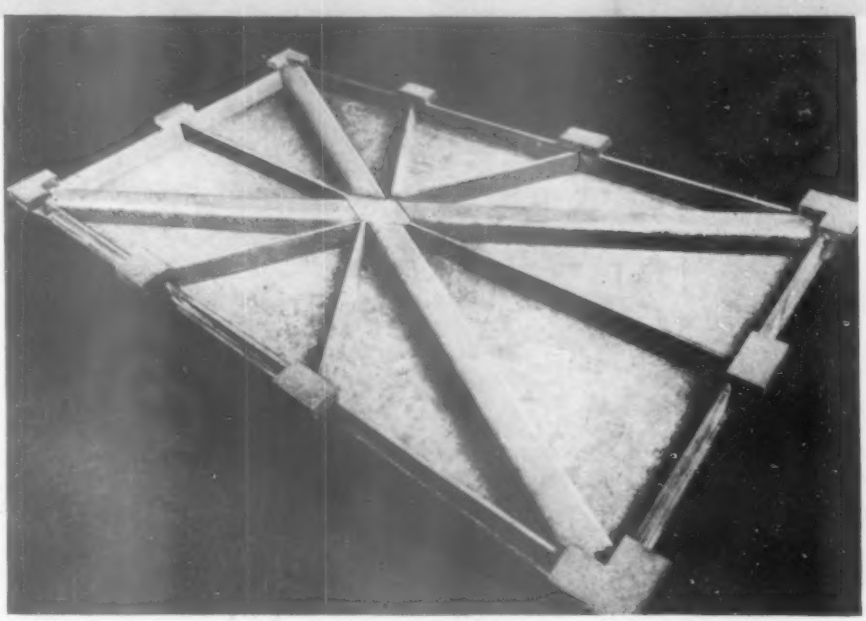


Fig. 14—Stiffener arrangement on underside of shallow machine bed. The flame-cut central member simplifies fitting and welding.

THE position of welded joints in the weldment deserves careful design consideration for several important reasons besides the reason of maximum access which we have already discussed. Where machined surfaces occur in the design, care in placing joints can effect economy. This is brought out by the comparative illustrations of Fig. 13. Clearly, if the joint is placed as in (*a*), a portion of the deposited weld metal will be removed in machine operations. Depositing weld metal is expensive, and unnecessarily removing it is wasteful. The joint in (*b*) shows how the amount of necessary weld metal has been reduced. The joint after it is machined needs to have only the cross-sectional area shown in (*a*). Still other economies might be effected by positioning the joint as shown in (*c*), which eliminates the kerf and its cost, or in (*d*). The joint shown in (*d*) also simplifies fitting, in contrast to the joint that is detailed in (*a*).

Spoke Intersections

The intersection of spoked or diagonal members usually presents a type of joint difficult to fit and costly to weld if proper external contours are to be maintained. In Fig. 14, the diagonal pattern of the box stiffeners on the underside of the machinery bed is highly desirable from the standpoint of obtaining maximum rigidity.

Fig. 13—Economical and uneconomical methods of placing welded joints where the top surface is to be subsequently machined. In (a) a portion of the deposited weld metal will be removed in machining. The joint in (b) reduces the amount of weld metal necessary, the joint in (c) eliminates the cost of the kerf and (d) simplifies fit-up.

*Abstract of a paper prepared for presentation at the annual meeting of the American Society of Mechanical Engineers, New York City, Nov. 26-29, 1945.

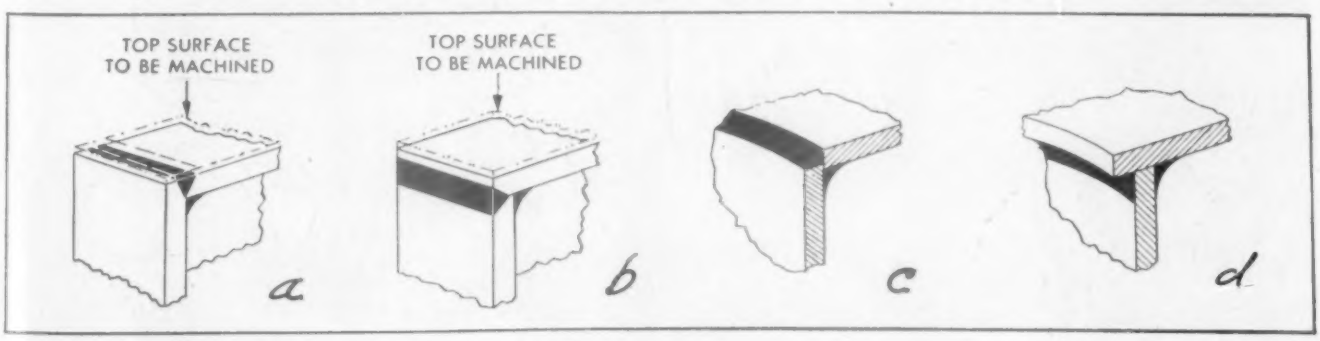


Fig. 15—The two halves of this large machine part were welded into one piece after shipment to destination. Note how the spokes are brought in to the central hub.

Their central intersection, however, presents a problem of the nature just described. Fitting and welding were simplified by the utilization of a flame-cut central member to obtain square joints at the intersection.

Fig. 15 shows a simple treatment of an intersection of spokes. The central member in this large sub-assembly was designed so that the spokes would not converge on each other. Obviously poor fitting and welding conditions would have resulted had the spokes been allowed to converge in sharp vees at the central hub.

Careful design treatment is imperative for intersections subject to high stress levels, fatigue, impact or a combination of these. Two contrasting designs of such an intersection are shown in Fig. 16. The left intersection was welded without benefit of a transition member, and an inordinate amount of weld metal was necessary in order to provide the curved contours. In addition, it is practically impossible to execute such a welded joint so that its full predictable strength will result, and X-ray inspection is also practically impossible. Fitting conditions are poor and the excessive amount of weld metal adds to warpage and shrinkage problems. Desirable features of a similar joint as executed in the right illustration are self-evident.

Dimensional Considerations

The designer should remember this generality: the fewer separate and different components that are required in a weldment, the cheaper and better the design will be.

At times, and particularly with secondary members such as ribs or stiffeners, slight changes will permit uniformity in size of different components, making quantity production by blanking economically possible. Another, somewhat minor consideration is the difficulty which the assembler or fitter will have in trying to identify parts that appear almost the same.

The designer should also keep in mind the possible utilization of hot-rolled bar stock, for often such material can be used by making a slight change in dimensions to conform to a standard stock size.

Regardless of how they are produced, all components are subject to dimensional tolerances. The designer must keep this in mind so that he can control the ill effects of cumulative tolerances. Fig. 17, left, gives a cross-section of a typical weldment in which the designer has kept cumulative tolerances in mind. The sketch at the right shows a similar cross-section in which the point has been ignored.

Ways to Counteract Warpage

Shrinkage and warpage problems will continue to be a factor so long as drastic heat gradients occur during welding. A degree of experience is needed to be able to predict such effects and to control and counteract them. It is impossible to discuss this factor in detail, but the designer should be able to sense the general aspects of such phenomena so that he will not develop designs impossible to produce within necessary tolerances.

The degree to which warpage will occur depends on the relative size of given welds and on their distances from the neutral axis of the assembly. Welding results in shrinkage both longitudinally and at right angles to the weld metal. The extent varies for sizes as well as types of welds. When the number of different sizes and types of welds occurring in an average weldment and their length and position with respect to each other are considered, it can be realized that control of warpage is an art rather than a science and depends to a large degree upon practical experience. The welding sequence should be carefully controlled as a counteracting measure, and special fixtures are sometimes used to restrain warpage during welding.

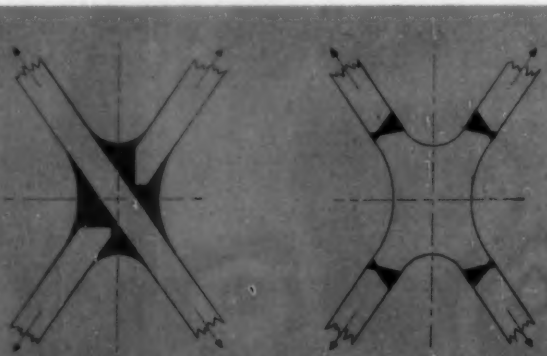


Fig. 16—Intersections without and with spline. The one without (left) requires an inordinate amount of weld metal.

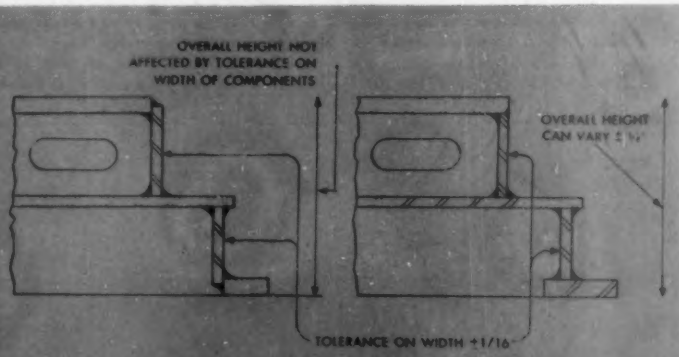


Fig. 17—Weldments in which the designer kept (left) and did not keep cumulative tolerances in mind.

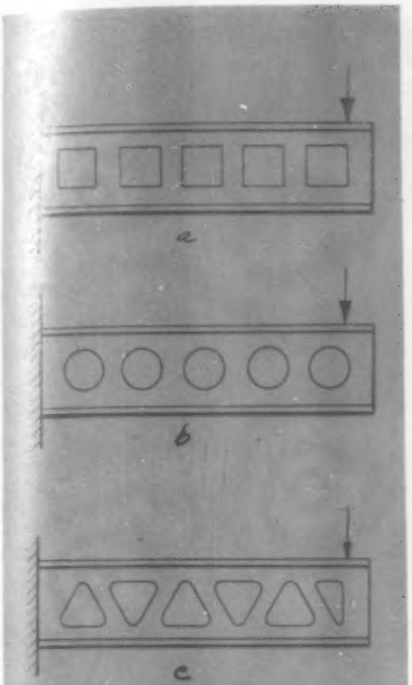


Fig. 18—Three designs of web openings for a cantilever beam. Design (a) offers the least rigidity for a given overall weight, (c) the most.

Conditioning and Inspection

It is an established practice to condition the weldment by removing spatter, grinding edges or surfaces where specified, and grit blasting when size permits. Spatter is removed both for appearance and to insure that it will not drop off progressively when the weldment is in service. Spatter can be detrimental mechanically, for instance, in a lubricating oil compartment.

Weldments are grit blasted in order to remove mill scale from plate surfaces and to facilitate visual inspection of welds. Undercuts are usually easier to detect after the weld is grit blasted.

Welds are inspected visually for proper size, surface cracks or other surface defects. X-raying is used to inspect welds for internal defects. Various specifications such as those of the ASME and the U. S. Navy provide inspection standards for the acceptance or rejection of welds by means of X-ray photographs.

Hydrostatic testing is often required by design specification. Oil-tight compartments should be checked and tested before the part leaves the weldery. Finally, the weldment should be laid out for a final inspection at the weldery to verify that it is dimensionally correct within specified tolerances.

When to Stress Relieve

A weldment that is to be subsequently machined to any appreciable degree should be stress relieved if the machined parts are to hold their relationship within service life. Any weldment subjected to severe stresses or to fatigue or impact should also be stress relieved. The magnitude or direction of locked-up stresses following welding cannot be predicted, but such stresses can be of a high order. If the stresses imposed by normal service loading have the same direction at a given point as that of a residual or locked-up weld stress, structural distress or failure can result.

No definite predictions can be made that difficulty will result if a given type of weldment is not stress relieved. Many weldments are in use that have not been stress relieved. Stress relief, therefore, may be regarded somewhat like insurance—insurance having a low premium rate because the per pound cost of stress relieving is usually only a fraction of a cent.

Specification Check List

This check list of specifications and drawing information will give the weldery proper and clear directions:

Steel specification?
Inspection agency, if any?
Weld sizes and to what standard?
General tolerances or any special tolerances?
Grit blast?
Grind? If so, where?
Stress relieve?
Paint? If so, what type and how many coats?
X-ray requirements? To what code?
Test—hydrostatic? If so, at what pressure?
Test—oil tightness?

A weldment should be specified clearly and concisely so that no misunderstanding will result and to insure that each potential vendor will be quoting on the same conditions. It is important, for instance, that the weldery know if the weldment must be produced under a code requirement.

Overall tolerance requirements on various dimensions of the weldment should be carefully considered. The

Fig. 19—Analysis on model of welded engine bed. Stresses under lateral load can be read from the strain gauges.

Fig. 20—Test set-up to determine actual stresses under load on a piece subject to internal hydrostatic pressure.

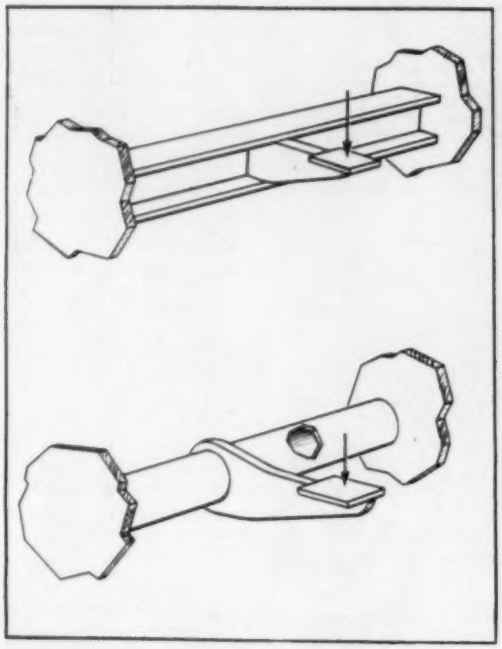


Fig. 21—Abstract example of two methods of resisting torsional force. The tubular design is by far the most effective and requires the least weight.

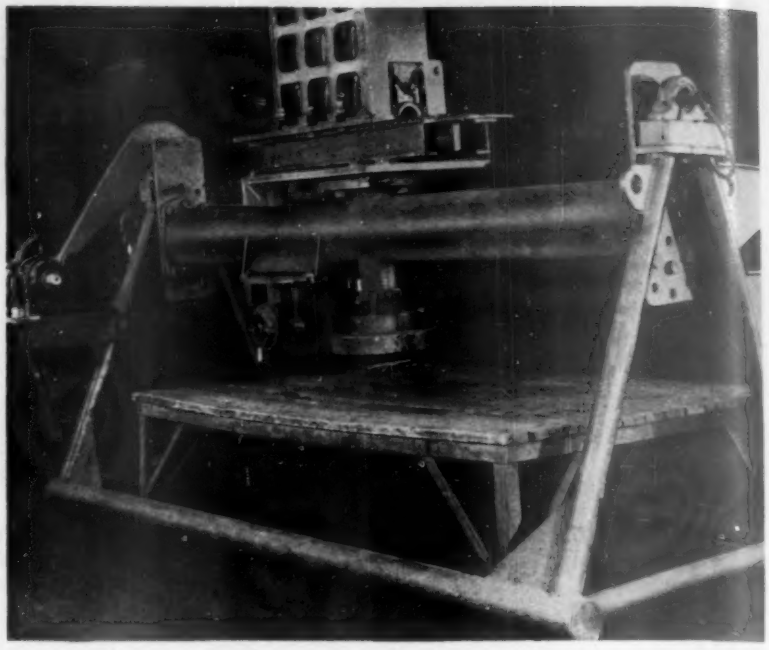


Fig. 22—Application of the principle of Fig. 21 to an actual structure. The main beam of this welding positioner is subject to combined bending and torsional stresses; hence it is made tubular in cross-section.

designer might be inclined to make everything tight to be on the safe side, but this can be a costly practice compared to that of intelligently evaluating requirements. Often a relatively close tolerance—under certain conditions of size, shape and amount of welding—can be costly to achieve. Proper study might show that the tolerance can be loosened without affecting the service performance of the weldment. In this instance, it is common practice for the designer to consult with the weldery.

Dynamic vs. Static Loading

Many types of weldments or components for weldments can be designed effectively into welded machinery parts. Categorically, machinery parts can be defined as parts required to resist or support moving forces; *i. e.*, parts subjected to dynamic loading. It is obvious that this definition distinguishes them from other types of structural members.

Dynamic loading or applied forces in motion can involve the additional factors of fatigue and impact to be considered in the design of the machine part and the proper selection of its material. If fatigue or impact are of major consideration, those properties of the material determining its resistance to such loading should be known. Such properties are generally referred to as the endurance limit (with respect to fatigue) and impact resistance (with respect to impact). The latter property (impact resistance) is sometimes related to temperature.

External and Internal Contours

The external contours of a part subjected to dynamic loading are a material consideration, particularly when fatigue is probable and especially when the member is subjected to primary loads. Points of changes in contour in a structure of irregular shape are especially critical.

Contours influence the effectiveness of a load-carrying member from a general standpoint. Proper contour denotes efficient disposition of material, which is fundamental in control of weight. Internal contours, those bounding openings in a structure, are worthy of careful consideration in the design of machine parts. As an example, the component illustrated in Fig. 18-*a* is less rigid for a given overall weight than that shown in Fig. 18-*b*. Disposal of the openings as shown in Fig. 18-*c* is even more effective from this standpoint.

Mechanical structures usually require openings of varying sizes and shapes for such reasons as fabricating or operating accessibility or for mechanical clearance.

The effectiveness of proper, flowing contour (and particularly its value in rigidity) is often mathematically indeterminate. Fortunately, model analysis is possible in cases where maximum rigidity or strength for least weight is important. Fig. 19 shows a set-up for an analysis of a welded machine part. Actual stresses in a product can also be determined by the use of such instruments as the strain gauges shown in Fig. 20.

Weight Control and Strength

Frequently, minimum weight is a

Fig. 23—Design details of spokes in welded machine part. Because of casting limitations, the spoke was designed initially as shown on the right. The shape on the left, the most effective from the standpoint of metal disposition, was made possible by welding.

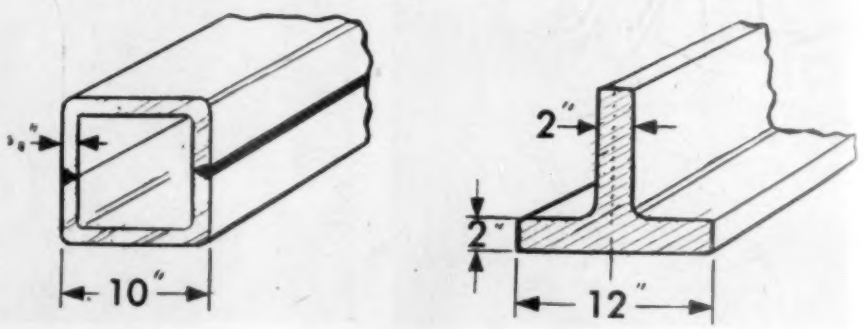


Fig. 24—Welded frame of a C-type hydraulic press. Rigidity rather than strength is the important consideration in this design.

major factor in designing structural members of machines. The weight of a mechanical part can be controlled by one or more considerations.

Sufficient strength is the first fundamental. A minimum factor of safety is important in designing for least weight. If it is known definitely that no internal voids can or need exist in a given cross-section subject to primary dynamic stress, one element making up the factor of safety has disappeared or at least is under control. It is obvious (as the previous discussion of contours reveals) that in designing for least weight, the shape should be as regular and flowing as possible.

In determining the strength factor, it is important to have exact knowledge of the magnitude, direction and location of the dynamic forces and their reactions involved in the machine. In designing machine parts for least weight, it is vital that these be predicted as closely as possible. After this has been done, the material resisting or supporting such forces or reaction can be disposed to best advantage consistent with mechanical clearance requirements.

As a specific instance, Fig. 21 shows an abstract example of two methods of resisting a torsional force. There is no questioning the effective disposition of metal in the tubular design. Nor is there any questioning that the effective disposition of metal insures the least weight. Fig. 22 shows an example of this concept in an existing machine part.

Another example of effective metal disposition is shown in the spokes of an enormous machine similar to the one in Fig. 15. The cross-section of the spoke is shown on the left of Fig. 23. This shape, the most effective, was made possible by welding. The cross-section on the right shows the spoke as it had to be designed initially because of casting limitations.

Designs for Rigidity

Rigidity or stiffness is sometimes the dominant factor in the design of structural parts, rather than strength as in the instances just discussed. The primary function of the spokes in Fig. 23 is to maintain alignment to the greatest possible degree between machined parts in the structure. Rigidity or minimum deformation dominates in the design of the C-type (open side) hydraulic press frame shown in Fig. 24. This weldment is composed exclusively of hot-rolled plate with metal thickness at any point dictated solely by design requirements.

A welded design that embraces directional control of rigidity is shown in Fig. 25. Purely vertical deformation or elongation is a secondary consideration in the function of this hydraulic press frame. A somewhat normal design for the structural parts of such a press comprises a top beam or platen, lower beam or bed and side housings. All of the separate pieces are integrated by two or four vertical tie rods secured by nuts at both ends. In such a design, the upper and lower beams will tend to deflect as beams in a manner detrimental to the alignment of tools and work in the press. This detrimental tendency is practically

Fig. 25—Welded steel belly band hydraulic press frame. Purely vertical deformation or elongation is a secondary consideration in the function of this frame.

eliminated by the design shown in Fig. 25, where the single structural member resists the working forces imposed on it in direct, uniform tension.

The stabilization of thin and unsupported expanses of metal requires watchfulness in the design of weldments for machinery. These thin and unsupported expanses of metal may be detrimental to the operation of the machine for several reasons. One is the possibility of "drumming" or vibration, another is fundamental instability and the third is the possibility of dents or distortion in normal handling of the structure.

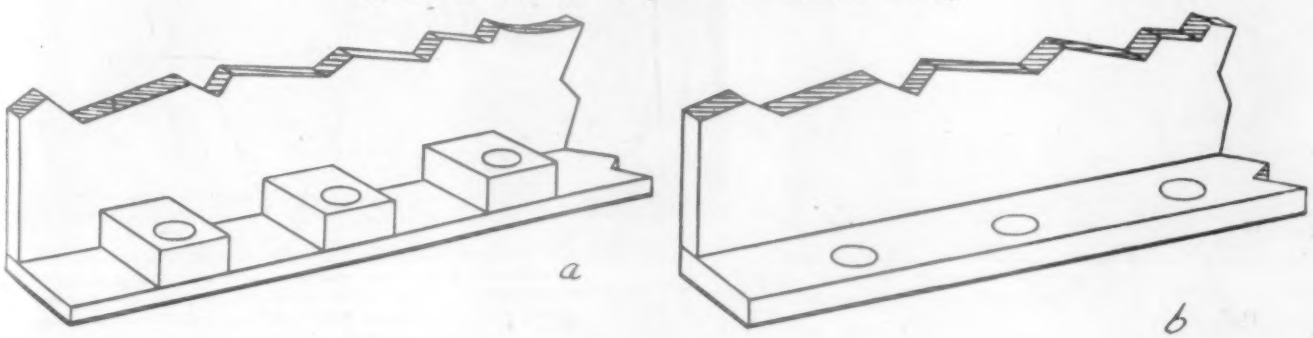
Many possible methods of stabilizing expanses of cross-section exist. Usually the imagination of the designer is fertile in the solution of the problem, once it has been recognized.

Few Size Limitations

Generally, the fewer the number of pieces bolted together to make up a machine structure, the less it will

(Continued on page 60)

Fig. 26—Comparative treatments of bolting flanges in a welded part. Treatment (a) does not affect the cost of a casting, but it is uneconomical for welding.



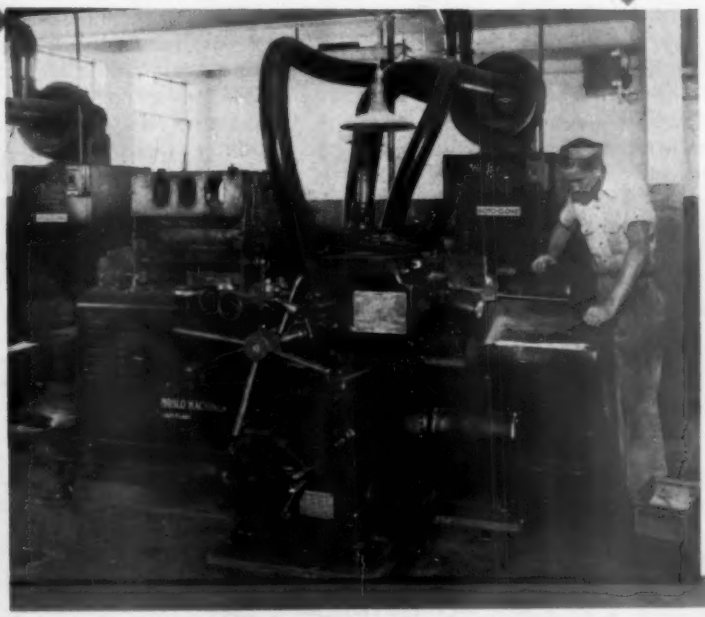
A trip to an *Electrode Plant*

A NEW plant introduces a new electrode! A product of the new electrode plant at the Bayonne (N. J.) Works of International Nickel Co., Inc., the new electrode was developed specifically for making machinable welds in cast iron by the Inco development and research division's research laboratory. Production follows the pattern indicated by the accompanying pictures and is carried out in automatic equipment. Each electrode passes five times through the new 90-ft multiple-conveyor oven, starting from the top and discharging at the lowest level end. Maximum capacity of the plant is over 1,000 lb of electrodes an hour. Besides the electrode for cast-iron welding, the new plant also makes electrodes for welding nickel, Monel, Inconel and various clad steels.

***STEP TWO:** The flux is mixed and formed into a slug under 1,500 lb pressure. The pressure eliminates air voids and provides a compact slug for the extrusion press.*

***STEP THREE:** The slug of flux is fed into the magazine of the extrusion press. Reloading can be accomplished within two minutes.*

***STEP ONE:** Straightening and cutting core wire for new electrodes developed in order to facilitate the welding of cast iron.*

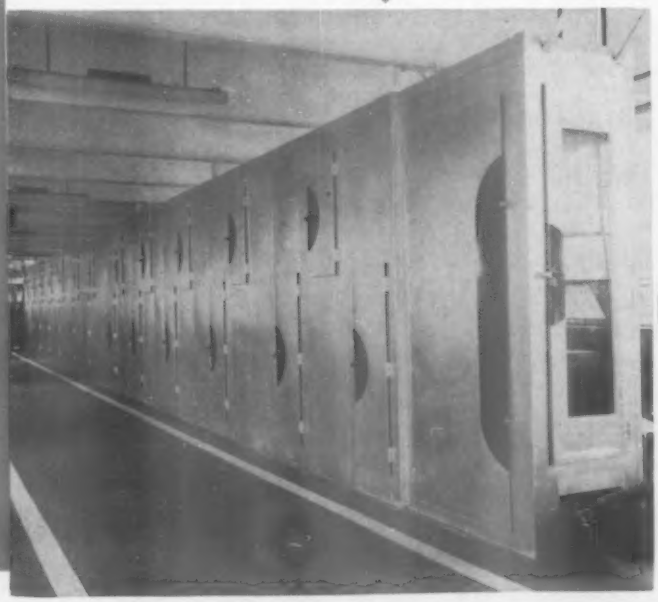


***STEP FOUR:** The straightened and cut rods are also fed into the flux extrusion press. These rods have been ground after straightening to insure accuracy of size and to remove end burrs. A clean, rough surface for automatic feeding is also provided by grinding.*

STEP FIVE: Leaving the extrusion press, the coated electrodes are picked up by a continuous belt conveyor and carried to the baking oven.

STEP SIX: All electrodes are inspected before they are allowed to enter the oven.

Arrows show how the materials flow from raw wire to finished electrodes



STEP SEVEN: The 90 ft oven provides a baking temperature of from 125 to 450 F. The electrodes pass five times through the oven on multiple-pass conveyors. About 45 minutes are required for baking.

STEP EIGHT: At the unloading end of the oven the baked electrodes are passed to another conveyor and carried away to be weighed and packaged.

Flash Welding for Jet Propulsion

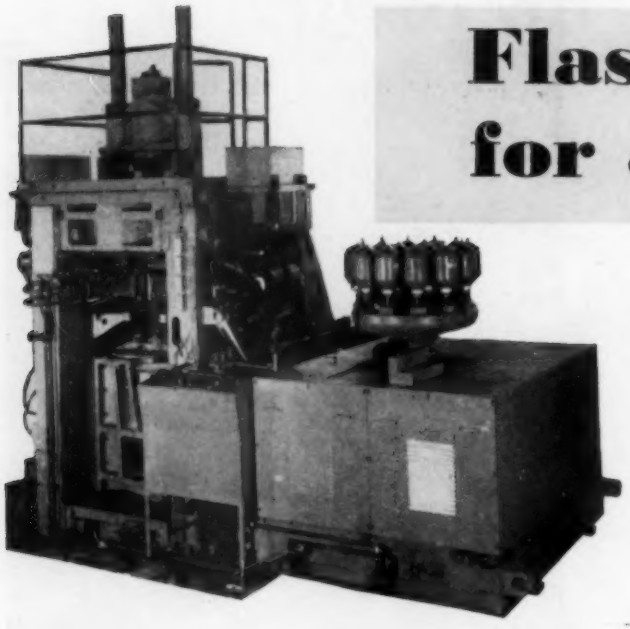


Fig. 1—Front view of vertical flash-butt welder designed for the job of welding bucket wheels to 3¼-in. shafts for jet-propulsion motors.

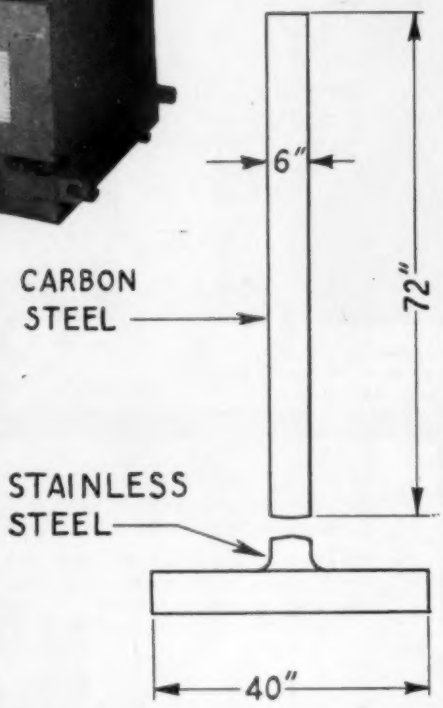


Fig. 2—Schematic diagram of weldment. Dimensions are the largest that can be handled.

Two of the largest vertical flash welders ever built, one for General Electric Co. and one for Westinghouse Electric Corp., were recently completed at the Taylor-Winfield Corp. plant at Warren, O. These machines were designed to weld turbine bucket wheels to 3¼-in. shafts for jet-propulsion engines. Each is hydraulically operated and is equipped to take shafts from 1 to 6 in. in diameter, 12 to 72 in. long, and bucket wheels from 5 to 40 in. in diameter. With slight changes in fixture design, these machines can be used to join similar pieces for other purposes. Fig. 1 is a front view of the welder, and the sketch, Fig. 2, is a schematic diagram of the largest weldment that it can handle.

Advantages of Vertical Design

Difficulty in keeping stresses in a straight line on the conventional type of horizontal flash-butt welder led to the vertical design of this machine. Its hydraulically actuated dies permit close work alignment and minimize die deflection at the time of upset.

This machine is comprised mainly of two cast-steel frames in a vertical position. These are separated by cast-steel brackets, which are bolted to the frames at each end. The upset slide is driven by a hydraulic cylinder of 35-in. bore, which delivers a force of 850,000 lb at line pressure of 1,000 psi.

Keys position both brackets, the upper bracket being insulated electrically from the side frames. The upset slide is guided by two attached slide brackets, moving vertically in bearings in the side frames. An adjustable bucking nut on the lower end of the piston rod limits the travel of the hydraulic piston. The upset slide's position and travel are shown by a large calibrated dial and pointer, mounted on the right hand side of the frame. The platen is mounted on the upset slide.

Clamping Methods

Clamping arms hold the bucket wheel firmly on the platen and also serve as conductors of the welding current. Hydraulic cylinders attached to each of the slide guide brackets actuate the clamping arms. The upset pressure is transmitted to the bucket wheel by the upset slide's integral back-up screw, which is adjustable to butt firmly against the bottom of the bucket wheel.

A hydraulic toggle-operated horizontal clamping fixture on the lower face of the upper bracket clamps to the shaft to be welded to the bucket wheel and supplies the welding current. Warning lights located at the control station indicate whether or not clamps are in correct position. The upper back-up screw, which butts against the upper end of the shaft being welded, absorbs the upsetting force transmitted to the shaft. Means are also provided for proper alignment of the shaft and wheel.

Attached to the hydraulic (oil) reservoir is a pumping and control unit supplying controlled hydraulic pressure. The clamping cylinders and the large upsetting cylinder are supplied 96 gallons of oil per minute at 1,000 psi by two duplex pumps. Oil filters are located in the suction lines, and the oil is kept at proper operating temperature by cooling coils submerged in the reservoirs.

Nitrogen Pressure Accumulator

A new type of pneumatic accumulator using nitrogen is mounted on top of the pumping unit. The possibility of an explosive mixture being formed is reduced by the use of nitrogen instead of oxygen. Eighteen drawn-steel bottles hold the nitrogen at a precharged pressure of 750 psi to provide a very large flow of oil at high pressure at the actual moment of upsetting.

Patented control valves aid in the delivery of the oil directly to the upsetting cylinder. A follow valve controls the travel of the upset slide during flashing, a dumping valve enables rapid upset and a variable-speed (adjustable voltage), motor-driven cam controls the follow valve during automatic flashing.

Three types of operation may be employed: manual, semiautomatic, or completely automatic. In manual operation, the amount of flashing and upset is controlled by a hand lever. In semiautomatic operation, manual starting of flashing is necessary, but the motor-driven cam takes over control of the follow valve at a predetermined point in the operation. In automatic operation, a preset rheostat governs the cam motor to control the speed of flashing, and the cam rise during the complete welding process controls the amount of flashing.

The heart of the jet-propelled engine is a solid steel shaft to which a turbine bucket wheel is joined. Normal horizontal flash welders couldn't be used so special hydraulically actuated vertical welders were designed.

Mounted on the side frames and connected in parallel are the two 600-kva transformers which provide the welding current. One side of each transformer is connected to the bucket wheel and the other to the shaft by means of the clamping devices previously described.

Electronic Current Control

Four 2,400-volt electronic contactors control the equipment, and each contactor has two high-voltage ignitron tubes. The phase-shift method of electronic control is used to adjust the welding current in fine steps. Successful welding of turbine bucket wheel materials is largely due to this method of control.

Interlocks between the front and rear hinged doors provide for automatic drop-out of the main circuit breaker whenever the doors are open. Arrangement has been made for connection with incoming power and water lines from the floor.

With the exception of loading, unloading and adjustment, the machine can be operated by one person at the control station. A panel of controls aids the operator in the preselection of welding time, hydraulic pressure, etc.

The pieces to be welded are placed in their proper positions in a carriage-type fixture mounted on rails, and the carriage is pushed into the machine against a stop. The work is thus presented to the machine in an assembled position. The fixtures then clamp the bucket and shaft in the proper position, and the carriage is removed. After welding has been completed, the assembly is removed from the machine by the same carriage. The result is a jet-engine turbine.

In the present form as developed by Westinghouse, the jet-propulsion gas turbine is a straight-line producer of power. All four of its major components—compressor, combustor, turbine and jet nozzle—are lined up one behind the other so that power is not lost in changing the direction of flow of the column of air that roars through the turbine.

A "Turbine in Reverse"

This straight-line design is made possible by the use of an axial flow air compressor—a "turbine in reverse"—which sucks enormous quantities of air into the engine. Thus the whole jet-propulsion power plant can be made much smaller, more compact and more direct in its action than other designs using the larger centrifugal compressor.

Fig. 3 shows the "business end" of a jet engine designed by Westinghouse to power Navy combat aircraft. Through this jet orifice a sizzling 50-ton-an-hour blast of combustion gases streams at more than 1,200 mph to give the engine its propulsive thrust. The shape of the nozzle is such that the gas doubles its speed from the time it leaves the turbine two feet back of the tip, increasing in velocity from 600 to 1,200 mph. This acceleration takes place in only 1/700 of a second—so fast that the forces of acceleration acting on each molecule are 20,000 times the force of gravity.

One of the Westinghouse jet engines already revealed to the public weighs less than half a pound per pound of thrust—less than half the weight of piston engines. It also has a total diameter of only 19 inches, again just half that of an "up-and-down" engine of comparable horsepower. When first brought out, this model was the smallest, lightest and most efficient aircraft engine in the country for its power, but it has since been superseded by later jet designs.

The "baby" jet engine shown in Fig. 4 is only 9½ in. in diameter and was originally designed to power an American version of the buzz bomb. Its turbine spins 566 times a second, and its jet stream delivers 275 hp at 375 mph. Some version of this engine may see service as a power source for aircraft cabin supercharging, wing de-icing, driving helicopters and to power personal planes. In a flivver plane, however, it would drive a propeller since jets are inefficient at low private-plane speeds.

Peacetime production of gas turbines by Westinghouse will require the facilities of a $10,000,000 plant and research laboratory, now nearing completion near Philadelphia.

Fig. 3—This is the "business end" of a jet engine designed by Westinghouse to power Navy combat aircraft.

Fig. 4—These are two versions of the jet aircraft engines designed and built by Westinghouse for the Navy Bureau of Aeronautics. The engine on the left was designed to power combat planes. The "baby" at the right is only 9½ in. in diam.

★ PRODUCTION

Welding Electrical Equipment

Welding is replacing casting as a means of fabricating pieces of large electrical equipment such as generators and mercury-arc rectifiers. Interesting new techniques have been developed for vacuum-tight seams and joints.

By WILLIAM SPRENGER *and* VICTOR E. HULEN

Transportation and Generator Division, Westinghouse Electric Corp., East Pittsburgh

ELECTRIC generators and vacuum equipment were at one time considered impracticable to weld, both from the standpoint of strength and also because of distortion and costs. It is now possible to successfully fabricate such products by welding. Although many of the techniques employed are basic, each piece of equipment requires a slightly different approach.

Generators and Waterwheels

Some frames for large hydrogen-cooled a-c generators and waterwheel generators weigh as much as 40 to 50 tons. On such equipment the weld must not only be strong enough to carry the weight but must be gas-tight and pressure-proof as well.

In order to get a quality weld, the parts to be joined are carefully fitted. Those parts which are not subjected to high stresses are flame-cut to close tolerances of from ± 1/16 to ± 1/8 in., depending on the thickness of the members. Since a machined fit gets the parts closer together and subjects the weld to fewer internal stresses, this method of fitting is used on all heavy members and on equipment designed to rotate at high speeds. The machined fit also enables the weldor to exercise more care in building up his bead.

Precleaning is done in the usual ways—shot blasting for all carbon steels, pickling on alloy steels and flame-priming on heavy slabs. In addition, a weld-cleaning hammer is used to remove scale on multiple-pass jobs.

Welding Silicon Steel

Silicon steel is required for some generator applications. Although this alloy has good electrical properties in that more magnetic lines of flux can be made to run in one direction, it is difficult to weld because of its inherent brittleness. One practice is to heat the parts in a furnace and weld them while hot. Straightening, if necessary, is also done while the parts are hot, for otherwise the welds would crack. After being joined, the members are stress relieved in an annealing furnace.

Another satisfactory method of welding silicon steels is to use an electrode which deposits a very ductile

Fig. 1 (above)—The inner frames for hydrogen-cooled and waterwheel generators are made in half or quarter sections because of their large sizes. The rings, spoking bars and structural supporting members are first tack welded, and then a skip-welding procedure is followed to minimize distortion. This weldor is working on a frame for an 81,250-kva hydrogen - cooled generator.

Fig. 2 — Foot-type control switches are standard on welding positioners (right) because they allow the operator freedom of both hands for manipulation of the electrode holder.

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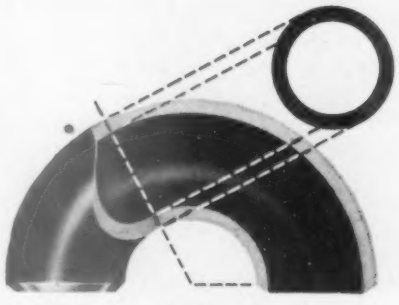

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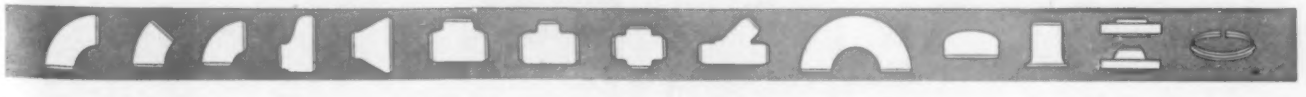


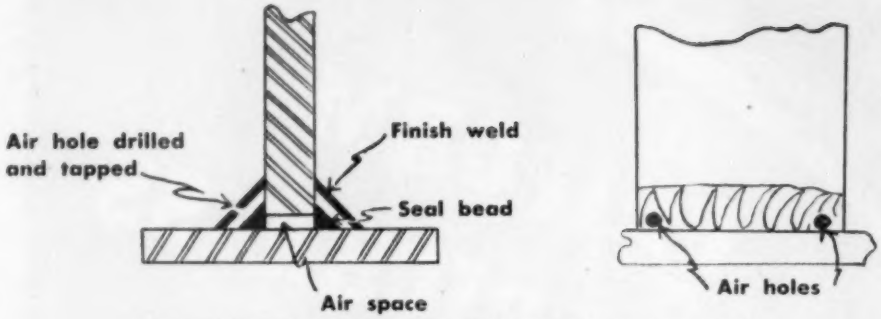


Fig. 3—Joints and seams for vacuum-tight equipment are given a seal bead inside and outside before finish welding. Holes are then drilled and tapped to permit the intervening space to be air tested.

metal, but such a rod is used only on low stressed parts.

Waterwheel frames are made in half or quarter sections because of their large size. Special care must be taken that these frame sections, when completed, are not pulled in or out at the partings. The weldors must follow a prescribed technique and as they are welding must watch with utmost care the points at which the frame begins to pull and the direction in which the pull takes place. This can be detected in several ways: by taking physical dimensions, by measuring or by gauging while in the process of welding. A more definite practice has been to hang a plumb bob at the top of the frame. The movement of the plumb bob indicates the movement of the frame as soon as it takes place. In some cases braces are welded across the diameter to hold the size while the frame is being welded. In no case are large frames welded without first considering some method of protection against distortion.

Skip-Welding Technique

The inner frame for an 81,250-kva hydrogen-cooled generator, Fig. 1, is an interesting example. It is made of semicircular rings having a radius of approximately 45 in. The rings are set on the floor and the machined parting bars are put into place and tacked; the top and center rings are added next. The weldor then tacks in the supporting members and starts building up his beads. He welds in a structural member at each end, and then goes around to its opposite on the other side of the circle. This skip welding is followed until all the pieces are in and welded. If multiple passes must be made on any members—and there are some which require more than a single bead—the same procedure is followed.

Improved methods have made it possible to premachine items before they are fitted and assembled. This decreases machining costs by making it possible to use smaller machine tools. A great saving is also realized in handling time; for example, the setting up of jobs on large boring mills and planers.

Locating jigs and fixtures are necessary to maintain dimensional tolerances on premachined equipment, especially when thin metal structures are being welded. Even when jigs or fixtures are to be used, the necessity of properly tacking items in position must be impressed upon the fitter and weldor. Poorly tacked items may lose the original dimensions. Anticipated warpage may be controlled during welding by tacking braces on areas that contain items welded on only one side.

Self Stress Relieving

The factor most important in distortion control is the direction of the weld with respect to open ends. In welding heavy pieces with multiple-pass deposits, methods may be found whereby the welds will stress relieve each other. This lessens distortion to some extent. Of course, furnace annealing is preferred whenever it is possible.

Considerable savings are realized by the use of welding positioners (Fig. 2). The advantage of having all welds in a downhand position enables the operator to produce better quality welds at a much greater speed. Most of these positioners are equipped with variable-speed controls. Foot-type control switches are standard because they allow the operator freedom of both hands for manipulation of the electrode holder. This eliminates the "bump" on the weld that would otherwise result from starting and stopping.

Vacuum-Tight Joints

Vessels to be subjected to a vacuum may be cast or fabricated by welding. One advantage of welded fabrication is that castings are much more porous and will present a leakage problem not present in the rolled plate used in fabrication.

A few years ago the atomic-hydrogen welding process was considered the only satisfactory method for making welds capable of holding a vacuum. The conventional metal-arc process is now being used quite satisfactorily and with greater speed.

Examples of vacuum-tight welds are found in the mercury-arc rectifier and its diffusion pumps. This equipment creates and maintains a pressure reduced to approximately one millionth of an atmosphere. It can readily be seen that only the highest quality of welding will serve.

By closely adjusting the current and carefully positioning the work, weldors can eliminate slag, craters and gas pockets. Should any of these defects be found when the vessel is tested for leaks, it is necessary to chip them out and reweld. The carbon arc

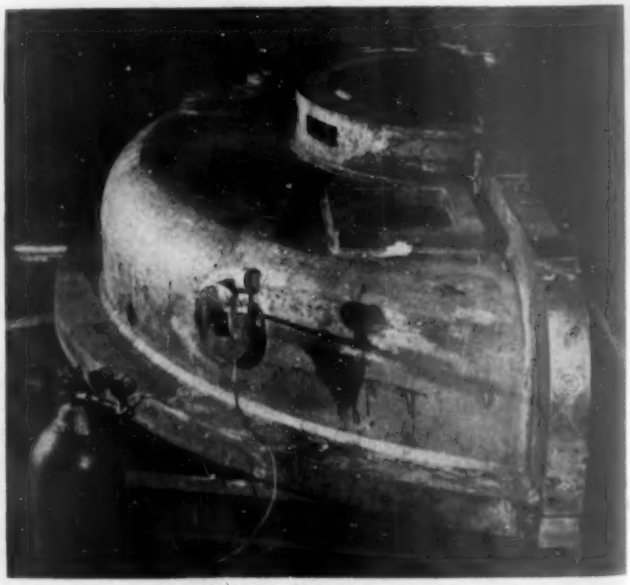
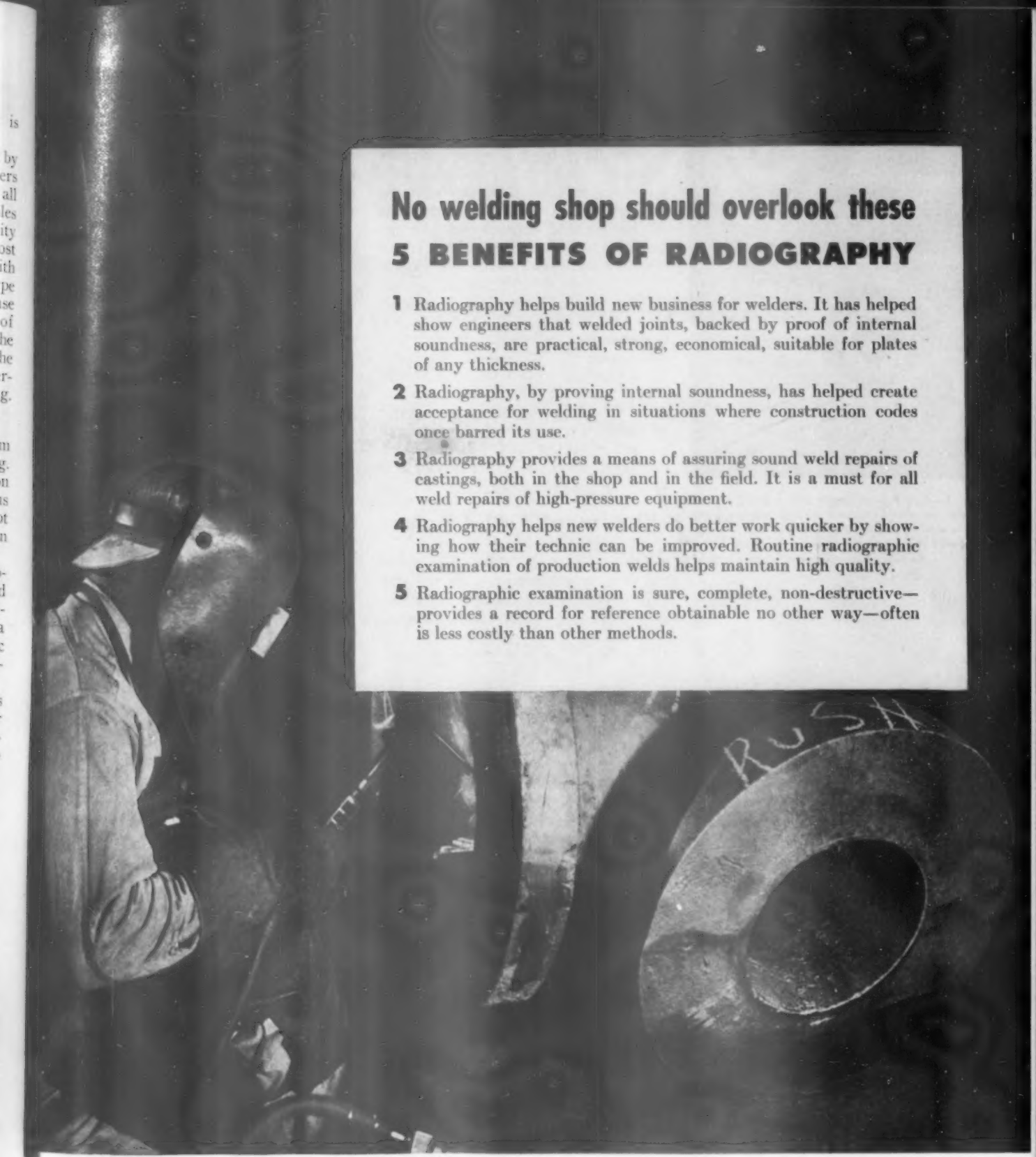


Fig. 4 — A specific example of vacuum equipment is this end dome for a hydrogen-cooled generator. Air pressure is supplied between the inside and outside seal beads, and a solution of liquid soap and water is brushed around the weld. Bubbles will form if a leak is present.



No welding shop should overlook these 5 BENEFITS OF RADIOGRAPHY

1 Radiography helps build new business for welders. It has helped show engineers that welded joints, backed by proof of internal soundness, are practical, strong, economical, suitable for plates of any thickness.

2 Radiography, by proving internal soundness, has helped create acceptance for welding in situations where construction codes once barred its use.

3 Radiography provides a means of assuring sound weld repairs of castings, both in the shop and in the field. It is a must for all weld repairs of high-pressure equipment.

4 Radiography helps new welders do better work quicker by showing how their technic can be improved. Routine radiographic examination of production welds helps maintain high quality.

5 Radiographic examination is sure, complete, non-destructive—provides a record for reference obtainable no other way—often is less costly than other methods.

NOW IS THE TIME to take a fresh look at industrial radiography . . . to investigate business-building advantages of qualifying *your* shop for any welding job that comes along. Your local x-ray dealer will be glad to discuss your problems with you . . . can make helpful suggestions. Or write to

EASTMAN KODAK COMPANY, X-RAY DIVISION, ROCHESTER 4, N. Y.

RADIOGRAPHY . . . ***Another important function of photography***

Kodak

Fig. 5—Cost figures justify the welding of two beads on such equipment as this vacuum pump for a mercury-arc rectifier. Should a leak develop, it would necessitate the removal of all the cooling coils brazed on the outer surface.

should never be used to cut out these bad welds because carbon-arc cutting leaves slag deposits and irregular surfaces and often too much is cut out or good welds are cracked because of the excessive heat.

Air Space for Testing

The procedure for welding vacuum-tight joints differs somewhat from conventional welding procedures. All joints or seams are first given a seal bead inside and outside before finish welding is done. The seal beads inside and outside form an air passage through which the welds can be tested, and the seal bead also makes a good base for the weldor to complete his welding without fear of getting the inside and outside welded together and closing the air passage. Together, the two seal beads are an insurance against leaks. Cost figures prove that this extra precaution pays for itself in eliminating leaks.

The sketch, Fig. 3, illustrates the general method. Air holes for testing are drilled and tapped after the seal beads have been deposited.

Testing with Nitrogen

Large vessels such as the end dome shown in Fig. 4 should have sections of the welds isolated in order to locate the leaks without requiring inspection of too large an area. The testing can best be accomplished by first applying air pressure between the welds and then brushing a thin layer of liquid soap-and-water solution on the outer surface. Bubbles will form in the event leaks are present.

If high pressure is desired, bottled dry nitrogen may be used to locate very small leaks. Restricting regulators should be used, however, in cases where dry nitrogen is employed. This pretesting method with dry nitrogen can save much time before the unit reaches its final vacuum test. An example is the vacuum pump for a mercury-arc rectifier shown in Fig. 5. Should a leak develop in this equipment, it would be necessary to remove all of the cooling coils brazed on the outer surface before the repair could be effected.

In addition to vacuum-tight equipment, the method of welding two sealing beads and pretesting with air or nitrogen can be used on vessels to be subjected to air, oil or water pressure.

Elements of Welded Design

(Continued from page 51)

weigh and cost and the stiffer it will be. The only limitations on the size of a weldment are those imposed by stress-relieving facilities and shipping clearance.

Another type of freedom that should be kept in mind by the designer of weldments is the possible use of higher-strength weldable alloys in highly stressed portions of the structure. The secondary components of the piece can be of cheaper plain-carbon steels. Weldable alloys add nothing in rigidity or stiffness, of course, since the modulus of elasticity remains practically the same.

To Weld or Not

Before the above decision can be reached, the factors of primary importance in the economic balance or competitive comparison of a welded steel design must be clearly evaluated. The fundamental reasons for assuming that a weldment is the proper medium must be unmistakably defined. These reasons may include natural adaptability and predictability, minimum weight and initial cost.

The designer and his employers must realize that the weldment undoubtedly will not resemble a casting in appearance. This does not imply that the welded machinery part will be displeasing to the eye. It means simply that anything produced by a radically different process will naturally be different in appearance. If it is not, the design should be reviewed critically because the chances are that it is not economical.

A simple instance appears in Fig. 26. The bolting flanges shown in (*a*) do not affect the cost of a casting particularly. In a weldment, however, such details necessitate a greater number of components and consequently a larger number of man-hours to join them. The alternate detail, (*b*), fulfills the same function at far less expense.

If weight reduction is of critical importance, the overall economic balance might dictate the added complication in the weldment. A natural question here is, "Why not cast it?" The answer has been found to be that a weldment can be designed which will weigh less than a casting without sacrifice of strength or rigidity. When quantities of duplicate parts are involved, other methods of achieving minimum weight at lowest cost are also available.

In making a decision on the value of weldments as structural members in a machine, the broad measures of their desirability should be known and considered. A weldment should not be used simply because a desire exists to design in this medium. Nor should a casting or forging be used if a weldment presents greater advantages.

Why Weight Is Important

Weight control or reduction may seem to have been overemphasized in this discussion. The weight factor can be important in machine design for many reasons. A fundamental consideration is the minimization of inertia forces in moving parts of machinery. Another is the pyramiding of the effects of weight or mass in mechanisms subject to high velocity, as, for example, the modern railroad passenger car.

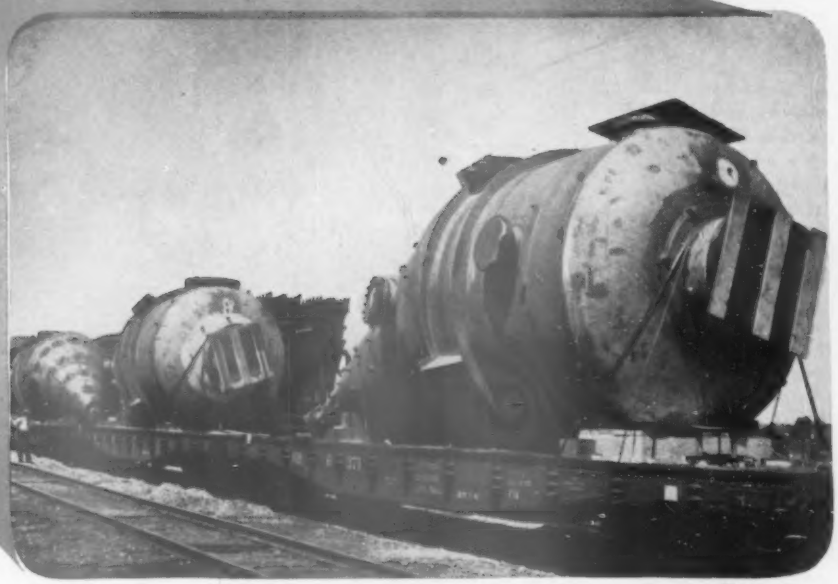
In relatively large pieces weighing 200 lb or more, weldments have been applied admirably where weight is important. Undoubtedly, the inherent features making such applications possible are predictability and the fact that the process imposes practically no limit on the thinness of sections.

The result of the application of the factors discussed here can best be illustrated by a particular instance of weight and space efficiency in the use of weldments. Comparison of a direct-drive, four-cycle Diesel engine of 1926 with an electrically driven, two-cycle Diesel engine of today reveals that the modern engine represents a reduction of 67.39% in cubic feet occupied per bhp and also a reduction of 58.40% in weight per bhp. At the same time the lighter engine of today is 50% more efficient than the heavier engine of 20 years ago. The development of welded steel construction has materially helped in reducing the weight.

THE END

Welding Research That *Keeps Pace* with Every Advance in Metallurgy

1927 A. O. Smith has always been alert to the possibilities of new alloys and new metals. When stainless steel was produced, A. O. SMITH welding laboratories promptly developed a stainless steel electrode The result was a weld that preserved all of the new alloy's corrosion-resistant properties.



1946 Welding research that has been continuous since 1917 stands behind the virtually constant flow of stainless steel vessels from A. O. Smith plants. Constructed in all sizes, often of intricate design, and made of solid alloy or with stainless steel linings, SMITHway Welded Pressure Vessels are in high-corrosion service the world around.

Not The Proof Is in Production . . .
The Proof Is in Service

A stainless steel electrode may have all of the necessary physical properties; it may be a delightful tool for the welder to use; it may even cost less than half of some other electrode—but it may be a disastrous investment for the fabricator if the weld fails after months or even years of service.

That's why SMITHway *Certified* Electrodes are specified for most "particular" jobs. Large volume operators recognize that there is no substitute for the extensive A. O. Smith laboratories in controlling and maintaining the *chemistry* as well as the *metallurgy* of stainless steel electrode metal. And large volume operators take no chances that a ten-cent economy today may cause a thousand-dollar failure in service two years, five years, or even ten years from now.

For detailed specifications of SMITHway Certified Electrodes and their application to specific welding jobs, send for the SMITHway Welding Catalog.

SMITHway A. C. Welders a Complete Line

Six models, including three new models of 150-, 200-, and 250-ampere capacity. Heavy Duty Models of 300-, 400-, and 500-ampere capacity. Write for complete specifications and prices.

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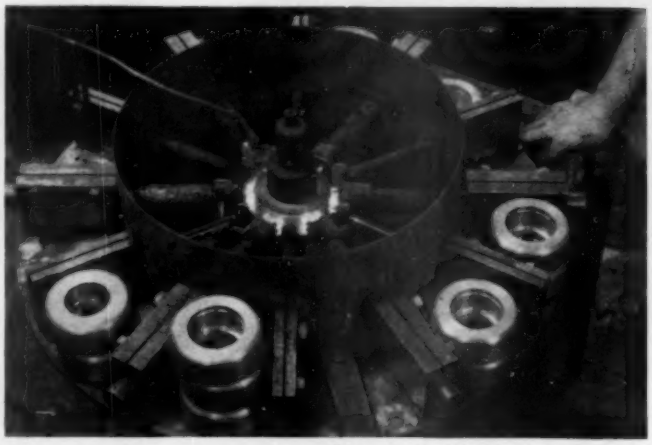
On the Job

Vertical Flame-Hardening

A VERTICAL flame-hardening installation is used by a manufacturer of materials-handling equipment to overcome the distortion that had previously resulted when small machined parts were furnace hardened. The flame-hardening set-up handles small parts such as gears, rollers, wheels, shafting, small pins and other circular parts ranging from 1½ to 12 in. in diameter. When furnace hardened followed by a water quench, these parts were often so distorted that they either could not be used or could be reclaimed only by costly grinding operations. With the flame-hardening process, both the rejection rate and finishing costs are substantially reduced.



Courtesy, The Linde Air Products Co.

Fig. 1—The vertical flame-hardener in action. All of the six heating heads are being used in the hardening of a machined roller. The single flame is a pilot light.

The spin-hardening method is used, the piece to be hardened being rotated rapidly while it is heated by a series of stationary oxy-acetylene flames (Fig. 1). When the part has been heated to the correct hardening temperature, the flames are withdrawn, and a spray of water is directed upon the work while it is still spinning. The spin-hardening method assures a uniform case over the surface area.

This machine is equipped with six flame-hardening heads. These are separate adjustable units, and any desired combination of them may be used, depending on the amount and type of heating necessary. Only three heating heads are used for hardening parts such as shafts and pins under 2-in. diameter. For relatively thin pieces, the number of heating flames per head can be reduced by replacing the rows of unneeded flame tips with plugs.

Exact procedure control is made possible by the use of a special control device which can be adjusted for each hardening job. The control box and timer are set according to the specifications worked out by the engineers, after which the cycle of heating and quenching becomes fully automatic. The heating flames and the water sprays are turned on and off automatically in correct sequence by solenoid valves. The operator merely positions the work to be hardened and pushes a button to start the sequence of heating and quenching.

The work is clamped in position in several ways. For small parts, such as small-diameter shafts and wheels, a quick-acting centering device is used (Fig. 2). For larger work, a tapered center fits over the spindle and centers the work (Fig. 3). This center is made heavy enough to hold the work firmly in the machine.

Fig. 2—A quick-acting centering device is used to hold small work in place. Only three of the heating heads will be used here.

Fig. 3—Placing a workpiece in the machine. The center fits over the spindle and automatically centers the work.

The parts are tested with a Shore scleroscope. Their hardnesses range between 71 to 75 on this scale, equivalent to a Brinell hardness of about 540. The depth of hardness varies from 3/32 to 1/8 in., and it can be controlled as desired.

» «

Ox-Cart Welder

IN Costa Rica, the Cartago Electric Co. employs old methods to bring modern arc-welding equipment to remote field projects that are inaccessible by road. The portable "ox-cart welder" shown in the picture below is one of nine a-c and d-c welders which are in continuous use by the Costa Rica public utility.

"Our company has used welding to build towers, poles, bridges, fans, etc," says John Saxe, manager of the Cartago Electric Co.

Courtesy, Harnischfeger Corp.

The old and the new unite in this ox-cart-hauled d-c welder in coffee-growing Costa Rica.

"During the war it was the only way in which we could have possibly kept our equipment in shape."

» «

Axle Housing Repair

By Lloyd A. Severts

Welding Service Engineer, Marquette Mfg. Co.

Due to lubrication failure, an area on the bearing surface of an automobile rear axle housing cracked up and "spalled off" under the roller bearing. As a new housing was not immediately available, it was imperative to do a welded repair job.

The damaged area was first ground down to solid metal (Fig. 1). The area was then built up with ⅛-in. stainless-steel electrodes, using an a-c welder at a setting of 120 amp. The weld as deposited appears in Fig. 2.

Immediately after depositing each short bead, a wet sponge was used to remove all heat. The reason for this was to prevent softening of the adjacent surface. After welding, the housing was mounted on a lathe faceplate and ground to size with a toolpost grinder.

Since this repair was made, the car has been driven several thousand miles under unusually heavy loads. The welded housing has given perfect satisfaction.

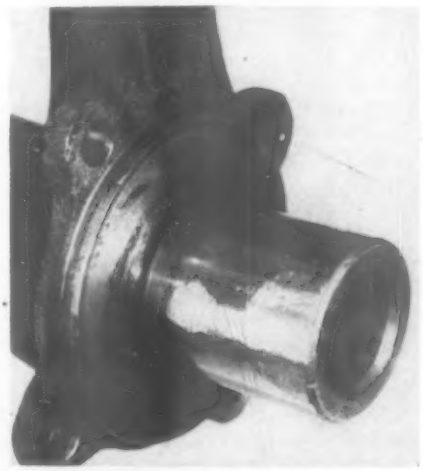


Fig. 1—The bearing surface before repair. Note spalled areas have been ground down.

Fig. 2—New metal was deposited with stainless-steel electrodes. When ground, the housing was as good as new.

TITAN

Bronze Welding Rods

for

Strong, TOUGH welds

★The outstanding factor in the recognized superiority of Titan Welding Rods is Double Deoxidation, a process exclusively Titan. By this method of manufacture the rod is kept definitely free of occluded and dissolved gases, and no gases are absorbed from any source during the welding operation. Free flow, full penetration, non-porous structure and great bonding strength and toughness are the results.

Titan Welding Rods include many analyses, each designed for a certain group of metals, although all Titan Rods do a good job on all metals with melting point above 1650°F. Write for literature which will enable you to select the best rod for your purpose.

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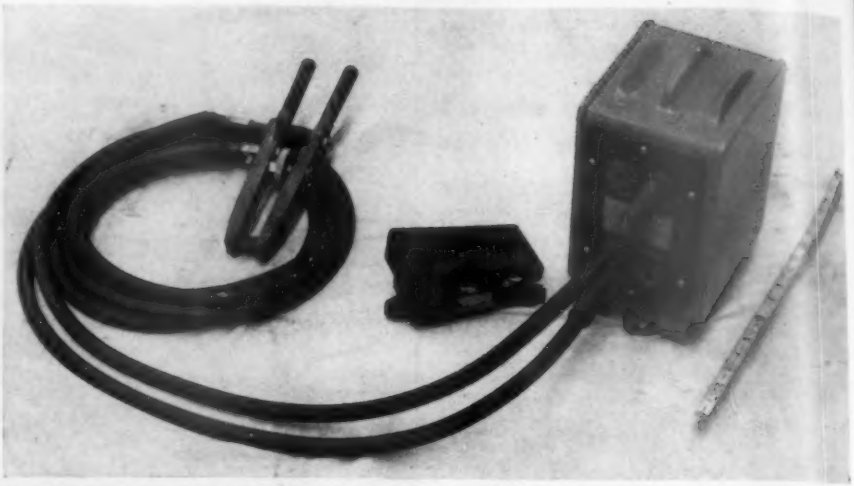
Brazers Go to the Work

ONE handicap in the use of resistance brazing has been the lack of portable production apparatus that can be readily taken to the job. To meet the need for portable brazing units for the joining of wire cables, strap connectors, pipe, etc., Westinghouse engineers have developed a self-contained family of incandescent-carbon brazing sets that require only connection to 220-volt power sources. Each set consists essentially of a transformer to provide high currents at low voltage, suitable voltage selectors and controls, and carbon-tipped tongs that can be clamped over the pieces to be joined. The high currents flowing through the carbons bring them to incandescence and so quickly raise the material to brazing temperature, which ranges from 1,200 to 1,500 F.



This portable brazing set consists of a transformer, voltage selectors, controls and carbon-tipped tongs. Altogether it weighs but 30 lb and requires only a connection to a 220-volt power source.

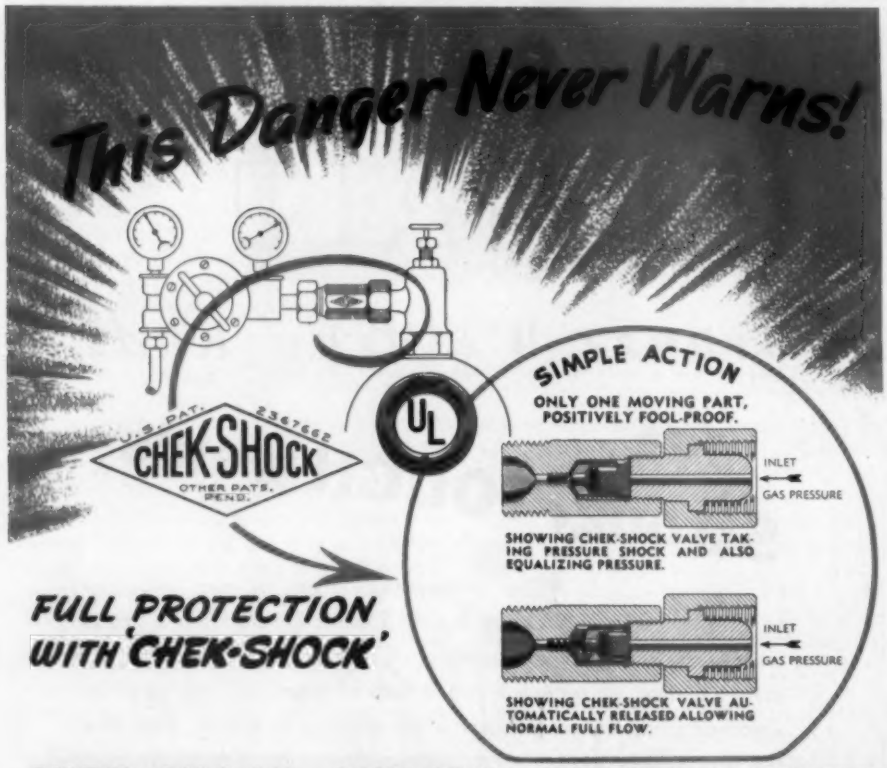
Three sizes, 5, 10, and 20 kva, comprise this group of mobile brazing elements. The 5- and 10-kva units are air-cooled. The 20-kva unit is fan-cooled and has a self-contained water-cooling and recirculating system to cool the brazing cables and tongs. The cooling system permits the use of a small portable unit for medium brazing work. Approximate weights of the three units are 30, 100 and 250 lb, and the corresponding secondary currents are 625, 833, and 1,667 amp.

» «

A Boon to China

ARC welding will be a significant factor in the future industrialization of China, believes Vee Tseng Lee, Chinese engineering student now studying American production methods under the sponsorship of his government's ministry of education. Lee, whom the camera caught during his course of instruction at The Lincoln Electric Company's school of welding, Cleveland, states that the process of arc welding will certainly appeal to the frugal nature of his countrymen because of its inherent economy as a construction and repair tool.

Vee Tseng Lee, an engineering student, traveled all the way from China to learn about welding and other American production methods.



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SOFTLY controls the vicious "jolt" of high pressure oxygen gas, thus eliminating regulator repairs and preventing possible injury to operators.

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. . . For An Old Process

The first improvement in years in equipment for an old process that has been handicapped by heavy, hot-running, burdensome tools

No. 500-C No. 300-C No. 200-C No. 150-C

The new line of TWECO CARBON ELECTRODE HOLDERS covers the practical range of manual welding and cutting. This range is from the lightest work up to 500 amperes; carbon sizes from ⅛ in. thru ¾ in. The range is covered by four sizes of air cooled holders from a 13½ oz., 150 ampere holder up to a 64 oz., 500 ampere holder.

Listed below are full specifications for the four sizes of TWECO CARBON ELECTRODE HOLDERS which are illustrated in the accompanying cut. The carbon is held by a spring actuated plunger operated from the handle of the holder. The hexagon head of the holder, as well as the exposed conductor tube and plunger, are steel. They are of ample capacity to conduct the current to the welding carbon, yet are of a high melting point material that has relatively poor thermal conductivity back to the main body and handle of the holder, thereby assuring a cool running tool.

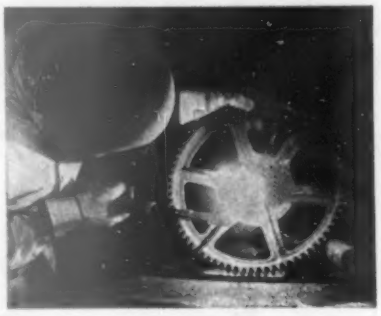
Each size of holder is well balanced when equipped with proper size cables. They are cool running within their rated amperage and carbon capacity range. The cable connection is simple clamp style. The No. 150-C and 200-C are furnished optionally with or without Quick-Attach Whip Cables and connection Lug. All parts are replaceable.

Holder No.	Carbon Capacity	Amperage Capacity	Length	Weight	Handle Diam.	Price
150-C	⅛"-¼"	150	10¾"	13½ oz.	1"	$ 7.50
200-C	3/16"-⅜"	200	13"	20 oz.	1¼"	10.00
300-C	¼"-½"	300	14¾"	36 oz.	1½"	12.50
500-C	⅜"-¾"	500	19¾"	64 oz.	1¾"	15.00

Phos "D" Copper Welding

Photograph at left shows a production carbon arc welding job on high copper alloy ground clamps. The D.C. carbon arc is unexcelled in the non-ferrous welding field. Better welds are produced economically with a great saving in time and efficiency. Carbon Arc is fine on light gauge stainless, aluminum and galvanized sheet, producing good welds with a minimum of warpage.

Cast iron cutting, cutting stainless steel casting risers and demolition cutting are readily accomplished with high amperage welding machines.



Cast Iron Cutting

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Short Cuts and Kinks . . .

Better Ways to Do It

A FEW of the many time and labor-saving ideas developed by tacticians of the production line are presented every month in this department. If you have a good welding idea of your own to pass along, you are hereby invited to contribute it to this section. Send anything you think suitable to: Short Cuts and Kinks, THE WELDING ENGINEER, 506 S. Wabash Ave., Chicago 5. Payment will be made at our usual rates.

Submerged-Melt Feed

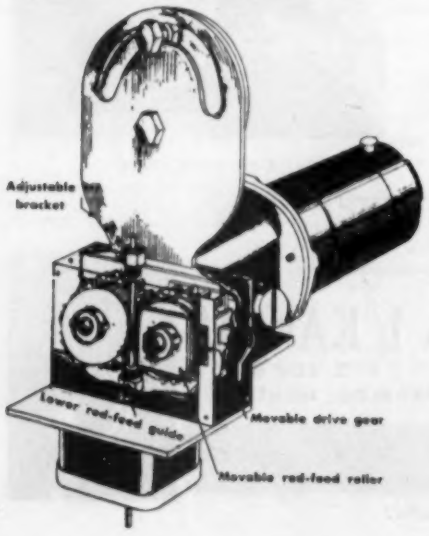
By Bob Roberts

THE conventional submerged-melt welding machines used at the Richmond No. 3 Yard, Richmond, Calif., had both a movable gear housing and a stationary gear housing. These two large and costly units required an excessive amount of maintenance and also a lot of man-hours of extra work every time the size of welding rod was changed.

It seemed to me that there was a better way, so I suggested to the Labor-Management Committee that a single rod-feed gear assembly and motor be used on these submerged-melt welders. This type of unit, I believed would greatly simplify the task of threading a different size of welding wire into the machine. The suggestion was readily adopted.

A small dual-voltage, shunt-wound motor was used with the rod-feed gear assembly. The self-adjusting compact rod-feed unit made it possible to do both fillet and flat welding with a submerged-melt welding machine. Costly controls were not needed and the decreased weight of the unit (36½ lb against 96 lb) made for easier operation.

Dual-voltage rod-feed motor and rod-feed gear assembly for submerged-melt welders.



Welding wire in coils could now be used, which permitted the machine to be operated on construction work where formerly only manual welds could be made. The original purpose of reducing maintenance costs and saving production time was definitely accomplished. It was figured that 162 man-hours were saved each week on rod adjustment alone. A total of 306 man-hours was saved per week.

The cost of the old assembly was $860, while the unit I proposed could be built for only $200. This resulted in a $660 saving.

» «

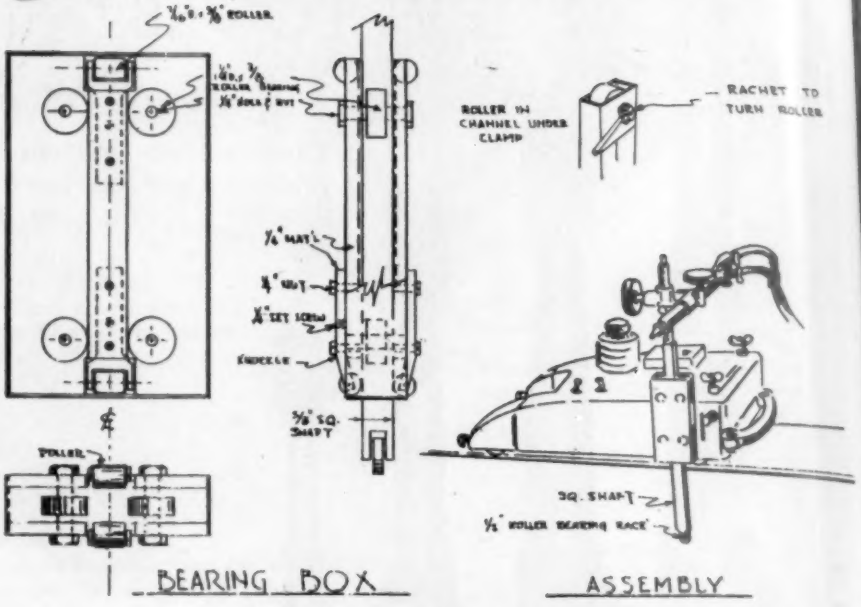
Contour Flame-Cutting

By L. Gorton

IT HAD always been difficult to cut the proper contour on an Isherwood bulkhead of a ship. In the Kaiser yard at Portland, the job had been done manually until I suggested to the War Production Drive Committee that a flame-cutting machine be built to follow the contour.

This machine consisted primarily of a standard flame-cutting machine to which was attached a square shaft floating in a bearing box. The trailing edge of the shaft has a ½-in. roller-bearing race. The shaft holds the torch and follows the contour. In operation, a track is laid parallel to the web to be cut, and the machine with the contour-following attachment is placed on the track. The shaft is full-floating; consequently, there is little possibility of sticking. All link and pantograph action is eliminated.

A cut which accurately duplicates the contour of the bulkhead may be quickly made. Since the operation is of a mechanical nature, mistakes and bad work are held to a minimum. In conjunction with the web holder, this contour follower saved us approximately 2,000 man-hours per month.



Construction details of contour-follower attachment for standard straight-line flame-cutting machine.

» «

Handy Pick

By W. F. Schaphorst, M. E.

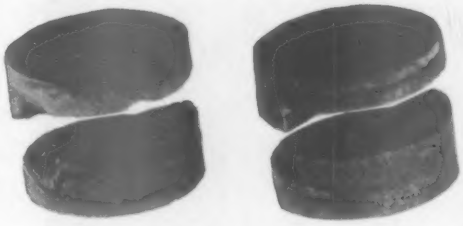
EVERY once in a while weldors find it necessary to swing a pick in order to do certain jobs. Here is a handy "pick kink": Don't try to swing the pick at all when you are working in cramped quarters. When there isn't sufficient elbow room for swinging, remove the pick head and slip it into a pipe (see sketch). An improvised pick of this kind will let you get into almost any corner.

With an improvised pick of this kind, you can get into almost any tight corner.

4 to 5 Times LONGER LIFE

Dressing Time REDUCED BY TWO THIRDS

and here's the proof!



UNTREATED **TREATED**

(Actual unretouched photo)

At left . . . Ordinary carbon brazing tips ready for the discard after only 500 operations. *At right* . . . Stackpole "F" treated brazing tips still ready for a lot more use AFTER 1300 OPERATIONS on the same job!

CARBON BRAZING TIPS

. . . with the famous Stackpole "F" Treatment

STACKPOLE'S recently developed "F" treatment for its Carbon Brazing Tips has resulted in units that operate at temperatures above red heat, require dressing far less often, and increase tip life four to five times that of untreated carbon by minimizing oxidation.

"F" treated Tips can be produced in practically any required shape or size. Their resistance to cracking or spalling permits the application of more radical temperature changes than is possible with any other material.

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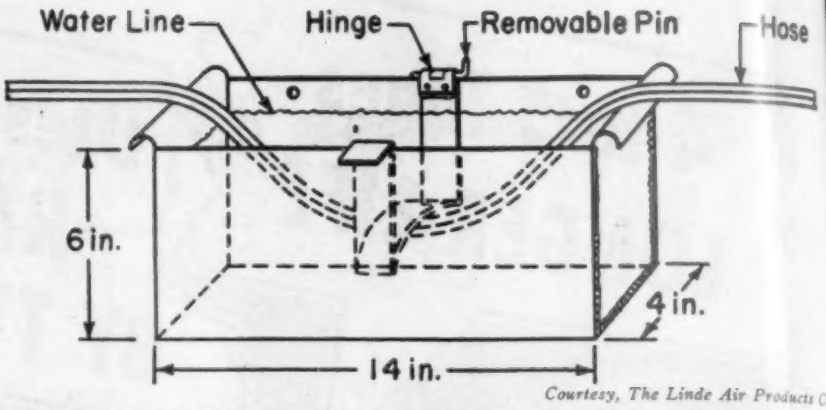
STACKPOLE

Hose-Testing Tank

THE sketch at right shows a portable tank designed to make it easier to test oxygen and acetylene hoses at frequent intervals. This tank can be made of almost any light-gauge sheet metal. The sides and bottom are one piece, 14 by 16 in., and the ends are separate pieces each 4 by 8 in. Two right-angle bends should be made 6 in. from each end of the large piece to form a "U" 14 in. long. Each small piece should be rolled, starting 2 in. from one end, over a piece of 1-in. pipe held in a vise. The rolled ends provide smooth surfaces for the hoses to slide on and also form convenient handles. The pieces are tack welded into place and then welded at sides and bottom.



Courtesy, The Linde Air Products Co.

Hose lines can be quickly tested with this portable water tank made of welded sheet metal.

The submerging bar is made by bending ¼-in. strap iron, 1½ in. wide. One end should rest against the tank, while the other end is welded to one half of a small hinge. The other half of the hinge is welded to the tank wall. The bar may then be held in place by the removable hinge pin.

» «

Off-Angle Flame-Cutting

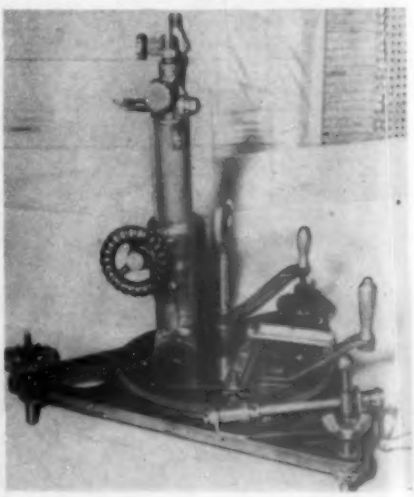
By S. C. Dunn

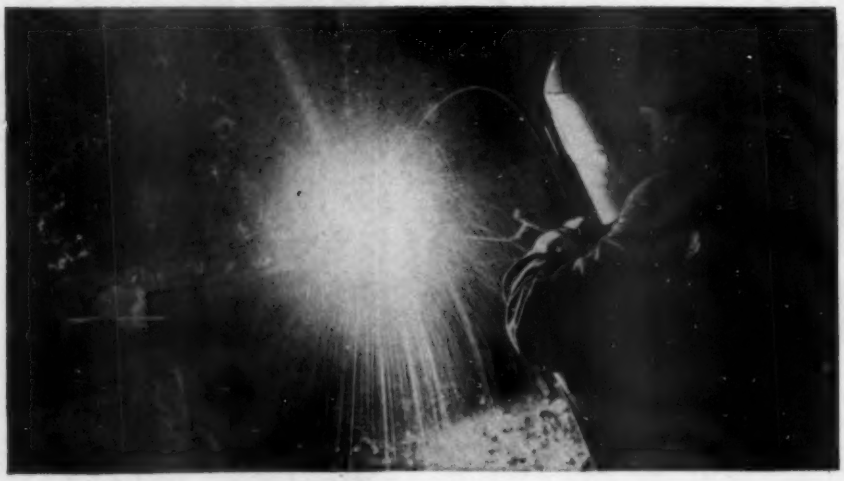
CONSIDERABLE difficulty was being experienced at Alabama Dry Dock in cutting circular holes in deck plating. As a rule, the flame-cutting operator was unable to obtain the proper bevel angle. The resulting misfitted holes caused weldors to spend many extra hours in order to make watertight welds.

I submitted to the War Production Drive headquarters an idea for a flame-cutting machine which would cut out circular holes on a vertical plane in the cambered deck plates. The purpose of my special attachment was to make a precision cut through the deck at any desired angle to allow deck stands to be fitted in a true vertical position. When this was done, the weldor's job was simply a matter of making a vee weld or flush weld around the boss under the plate.

The use of this attachment is estimated to have saved us over 200 man-hours per ship in direct labor.

This flame-cutting attachment permits a circle to be cut with any desired bevel angle.





No Perceptible Lag . . . or Surge

for Your Engine-Driven Arc-Welders

● Sensitive, responsive Pierce Fly-ball Governors compensate for load variations in engine-driven arc-welders—so promptly that there is no perceptible lag between striking of the arc and full recovery of current characteristics.

Pierce Governors have proved themselves as standard equipment on the finest engine-driven welders—because their dependable *centrifugal* action assures accuracy, complete dependability and long life. Without readjustment or service, they often outlast the engines they control. They never gum, or stick, or interfere with carburetion.

Specify Pierce Governors when you buy new engine-driven welding equipment—and write for full information if your present units are not Pierce-governed.

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Manufacturers of
Pierce Precision Governors and Sisson Automatic Chokes

PIERCE GOVERNORS

Why NELSON Automatic Stud Welding saves TIME . . . MONEY

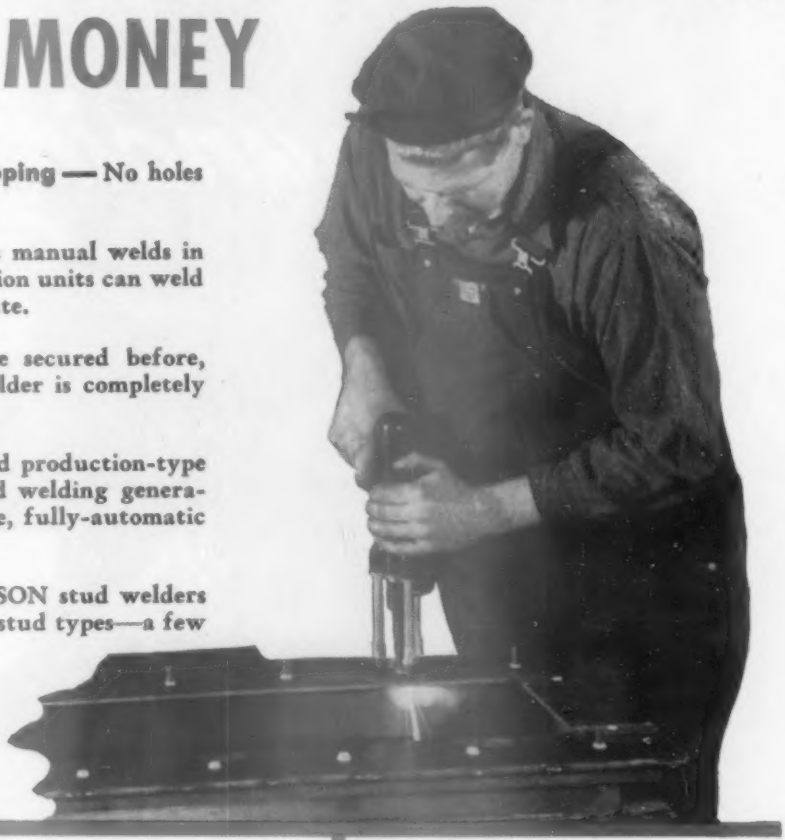
Eliminates Drilling, Punching, Tapping — No holes are required to attach studs.

Steps Up Production — Completes manual welds in ½ second or less; precision production units can weld as high as 20 or more studs per minute.

Simplifies Design — Studs can be secured before, during or after assembly; stud welder is completely portable, welds in any position.

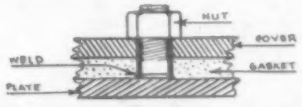
Easy to Install — Both manual and production-type stud welders operate from standard welding generators, and are equipped with reliable, fully-automatic controls.

Maximum Versatility — NELSON stud welders handle an extremely wide range of stud types—a few are illustrated below.



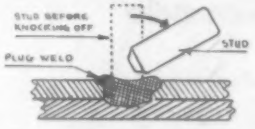
STRAIGHT STUDS

Blank or threaded, male or female, straight or shoulder type studs from 3/16" to 3/4" in diameter and up to 8" long may be welded in standard NELSON manual or production-type stud welders.



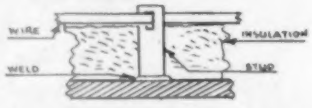
GROOVED STUDS

For extremely short threaded studs, for plug welding, or for blind riveting, the stud is grooved to provide for easy break-off at the correct length after welding.



LAGGING STUDS

Securing insulation, reinforcing wires or special attachments to metal surfaces is a fast, economical job with NELSON lagging studs. A typical application is sketched below.

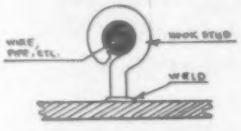


INSULATION PINS

Attaching insulating "blankets to metal bulkheads, walls or tank sides is a rapid "one-step" operation — the large-headed pin is pushed through the blanket and automatically welded on contact with the metal.

HOOK STUDS

A wide range of hooks and eyes is available for NELSON stud welding. Meat hooks, pipe or conduit hangers and similar styles may be automatically welded in ½ second or less.



NOW IS THE TIME TO GET THE FACTS . . .

Literature describing NELSON equipment and materials is yours for the asking — write or wire:

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Representing
Nelson Stud Welding Corp., Lorain, Ohio
Nelson Specialty Welding Equipment Corp.
San Leandro, California

OTHER NELSON FLUX-FILLED STUDS

P&H

"SM"

FOR SHEET METAL WELDING

(Class AWS-ASTM-E6013)

"BRUSH ON" WELD METAL

with this new spray type electrode

"SM" is a new, different electrode for welding light gauge steels. It's for production welding — so fast, so easy to use, you can virtually "brush on" weld metal. "SM" comes to give arc welding new ability in the *volume* fabrication of light gauge mild steels.

Nothing was overlooked in developing this latest P&H electrode. All P&H's knowledge and years of experience as a leading maker *and user* of arc welding equipment have gone into it. "SM" combines every desirable operating characteristic — for faster, cleaner, sounder, better appearing welds.

P&H MODEL WA-200 ARC WELDER. *Just one control for any* desired welding heat. Arc response is automatic. WSR (Welding Service Range) tells you the exact amount of *usable* welding current. "Visi-matic" calibration enables you to select instantly the correct current for each class of electrodes. Write for information.

AC OR DC — Yes, whatever your machines, AC or DC, whatever your work, "SM" performs perfectly. It's the true production electrode for welding thin gauge metals.

LOWER PENETRATION — You get less penetration—the desired amount of penetration with "SM." Gone are your troubles of "burn-throughs" and "suck-ins." Use "SM" on metals down to 20 gauge.

"DROP OFF" SLAG — A really unusual and important feature of "SM" — main reason why one of America's largest light gauge fabricators uses it exclusively. Slag removal is no problem with its "drop off" characteristic.

"SM" gives you—

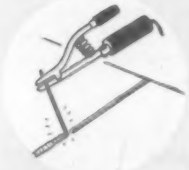
CONVINCE YOURSELF—TRY "SM"

ALL-POSITION — Whatever you're fabricating — auto or truck bodies, tanks, furniture, window frames, etc., you can weld them in any position. All-position welding rounds out "SM's" versatility — makes it an electrode you can't afford *not* to use.

SPRAY TYPE ARC—Specially developed coating gives "SM" *ideal* concentrated spraying action for faster, smoother, stronger welds on all positions.

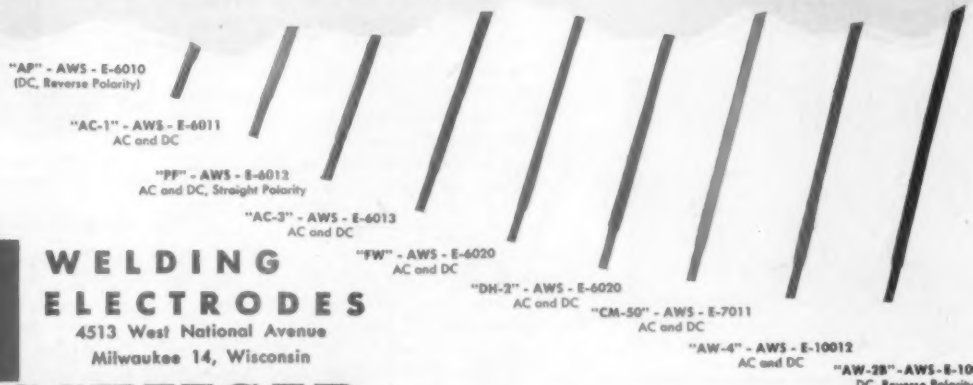
OTHER POPULAR P&H MILD STEEL ELECTRODES

There's a production approved electrode for every requirement in the complete P&H line. Below are just a few. Get complete information from your P&H representative or write us.



REDUCED SPATTER LOSS—The extremely small amount of spatter greatly increases welding efficiencies of "SM."

FLAT, THIN BEAD — Another important advantage: Its very smooth, flat bead. Say goodbye to "humped" or convex bead that requires expensive grinding, careful finishing.


"AP" - AWS - E-6010
(DC, Reverse Polarity)
"AC-1" - AWS - E-6011
AC and DC
"PF" - AWS - E-6012
AC and DC, Straight Polarity
"AC-3" - AWS - E-6013
AC and DC
"FW" - AWS - E-6020
AC and DC
"DH-2" - AWS - E-6020
AC and DC
"CM-50" - AWS - E-7011
AC and DC
"AW-4" - AWS - E-10012
AC and DC
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New Products to Use

Brazing Flux

★ A new silver-brazing flux recently made available for civilian production is known as "Nu-Braze Wonderflux No. 4." It melts and forms a protective coating over the metal surfaces at 480 F, a point well below the oxidation temperature of most metals. At 800 F, the new flux is actually water-thin, and will readily flow through clearances as close as 0.001 in. It is said to be especially effective on stainless steels.

The flux has a *p*H of 5-6, which means that it is only slightly acid. It can be painted on parts and allowed to remain for a long period without producing corrosion, manufacturer says. Since it is non-hygroscopic, flux trapped in an inaccessible part of the joint will not pick up water and so serve as a corrosion focus. After the water content leaves the flux at 212 F, there is no further effervescence.

The flux hardens to a brittle glass, which can usually be jarred from the brazed part or is easily removed by either hot or cold water. **Sherman & Co.,** 197 Canal St., New York City 13.

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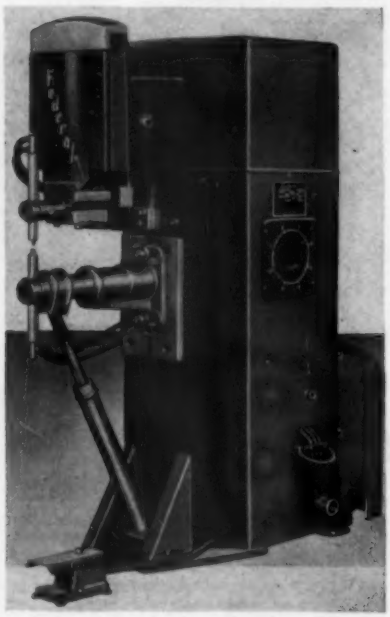

Federal PH-1 press-type welders are available for spot and projection welding.

Spot Welder

★ An automatic, hydraulically operated press-type Federal welder is being offered in capacities of 30,50 and 75 kva for both spot and projection welding. It is featured by an inverted hydraulic cylinder through which the welding pressure is applied. The cylinder is a part of the slide or ram, and the piston is the so-called fixed member, its upper end being secured to the top of the welder by a heavy transverse spring.

The adjustable spring serves a dual purpose: it actuates the switch initiating the timing controls, and it provides a quick reaction for a fast follow-up on the welding stroke. Welding pressure is adjusted by the hydraulic pressure regulator and gauge. Weld speed is governed by timing controls.

After the welder has been set for a specific job, the operator has but one control to consider: a foot switch attached to a flexible cable. A single light pressure and release puts the welder through a complete welding cycle. Automatic re-cycling will continue as long as the switch is held in contact.

Water-cooled transformers and electrodes are standard equipment, and water-cooled horns are available on special order. The three sizes have an overall range of work capacity from 26 to 6 gauge steel sheets or comparable material. **Federal Machine and Welder Co.,** Warren, Ohio.

» «

Heat-Treatable Stainless Steel

★ Now released from war restrictions, the new Stainless "W" is a heat-treatable stainless steel of the 18-8 type. Differing in this respect from ordinary 18-8 stainless, which it has not been possible to heat treat, the new steel has the high strength and corrosion resistance of 18-8 in all wrought and cast forms. The basic composition is so balanced as to insure without cold working the approximate completion of the austenite-to-ferrite transformation and the subsequent process of precipitation hardening.

In the annealed condition, Stainless "W" ordinarily has a hardness of 22 to 28 Rockwell C, a tensile strength of 120,000 to 150,000 psi and a yield strength of 75,000 to 115,000 psi. By proper heat treatment the hardness can be raised to 39 to 47 Rockwell C, the tensile strength to 195,000 to 225,000 psi with a yield strength of 180,000 to 210,000 psi.

A typical analysis of Stainless "W" is as follows: Carbon 0.07%, manganese 0.50%, phosphorous 0.010%, sulphur 0.010%, silicon 0.50%, nickel 7.00%, chromium 17.00%, titanium 0.70%, aluminum 0.20%, iron balance. The most important element is titanium, which serves the dual purpose of being the primary precipitation-hardening element and a strong ferrite former. With all other elements properly balanced, the optimum percentage of titanium has been found to be in the range of 0.40 to 1.00%.

Solution annealing serves to put the precipitation-hardening constituents of Stainless "W" into solid solution in austenite. Upon cooling to room temperature, the austenite transforms into ferrite, which is then supersaturated with the precipitation-hardening constituent. Aging consists of reheating (upon completion of the austenite transformation) to a temperature at which the precipitation-hardening constituents will precipitate out of the supersaturated ferrite and impart the desired change of properties. The solution-annealing temperature range for Stainless "W" begins at about 1,200 F, which is 100-200 F above the temperature at which the material begins to transform to austenite, and extends to approximately 2,000 F.

This new stainless steel can be successfully processed in standard equipment and no difficulty will be experienced with warping or dimensional changes in the course of heat-treating operations, manufacturer states. It is readily fabricated by spot welding, and high joint efficiencies can be secured by metal-arc, atomic-hydrogen and Heliarc welding operations, particularly when solution annealing followed by aging is employed as a postweld treatment. Machinability, according to shop tests, is slightly better than that of austenitic 18-8 stainless. Unlike most other types of 18-8, Stainless "W" is strongly magnetic. **Carnegie-Illinois Steel Corp.,** 434 5th Ave., Pittsburgh 30.

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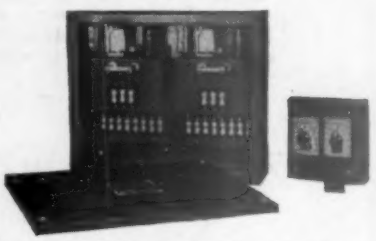

Photoswitch repeat-cycle timer for resistance-welding applications.

Repeat-Cycle Timer

★ Photoswitch repeat-cycle timer, Type 2T15U, is an electronic timer for machinery and process control. It is recommended for applications requiring two adjustable timing periods to run in a continuous cycle. The cycle is initiated by either momentary or sustained contacts, and provision for automatic re-cycling is provided. Each timing period is adjustable from 1/20th second to two minutes, and there are up to six (maximum) time ranges from 1.5 seconds to two minutes for each period of the cycle. Each range is represented by a timing element which is snapped into a clip on the front of the control. The timer may be then set for any intervals up to these maximums by dials located on the timer. It operates on 115 volts, a-c or d-c. **Photoswitch, Inc.,** 77 Broadway, Cambridge 42, Mass.

3 new features

"More Arc Time with" MARTIN WELLS' *Rod Saver* ELECTRODE HOLDER

1. New "Mitt-grip" sleeve. Ribbed construction assures positive grip, eliminates slipping in glove or mitt when changing rods.

2. Higher amp. capacity. New one-piece combination terminal and bushing, made of high conductivity copper alloy, increases amperage capacity. It will operate under sustained welding conditions on 5/16" electrodes at 400 to 500 amps.

3. Holders available with either 60° or 90° angle rod position hole. Option gives weldor greater flexibility, makes close quarter work easier.

Above:
MODEL 4H
400-500 amps
19 ounces

"More Arc Time"
Martin Wells
ELECTRODE HOLDERS
Los Angeles 1, California

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Grand Rapids—Air Reduction Sales Co.
Harrisburg—Air Reduction Sales Co.
Honolulu—Hawaiian Gas Products, Ltd.
Houston and throughout Texas—
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Huntington—Air Reduction Sales Co.
Indianapolis—Air Reduction Sales Co.
Jersey City—Air Reduction Sales Co.
Kansas City—Air Reduction Sales Co.
Lima—Air Reduction Sales Co.
Milwaukee—Air Reduction Sales Co.
Steel Sales Corp.
Minneapolis—Air Reduction Sales Co.
Steel Sales Corp.
Mobile—Air Reduction Sales Co.
Montreal—Rudel Machinery Co.
Nashville—Air Reduction Sales Co.
New Orleans—Air Reduction Sales Co.
New York—Air Reduction Sales Co.
Chicago Combustion Co.
Oklahoma City—Air Reduction Sales Co.
Omaha—The Balbach Co.
Fuchs Machinery & Supply Co.
Philadelphia—Air Reduction Sales Co.
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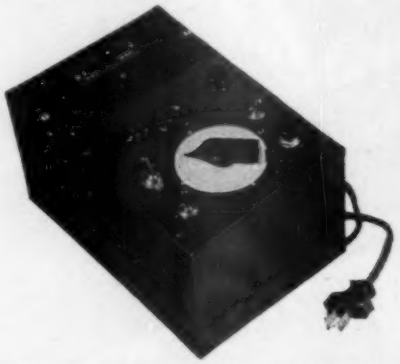
Williams & Co., Inc.
Portland—Air Reduction Sales Co.
Richmond—Air Reduction Sales Co.
Rochester—Air Reduction Sales Co.
Saginaw—Northern Supply
Savannah—Bay Welding Sup. Co.
St. Louis—Air Reduction Sales Co.
Steel Sales Co.
San Francisco—Air Reduction Sales Co.
Pitts & Loughlin
Seattle—Air Reduction Sales Co.
Shreveport—Air Reduction Sales Co.
South Portland—Air Reduction Sales Co.
Spokane—Gibson Welding Supply Co.
Toledo—Air Reduction Sales Co.
Welder Service Co.
Tulsa—Air Reduction Sales Co.
Vancouver, B.C.—Scott-Foster & Co.
Warren—Air Reduction Sales Co.
Wheeling—Air Reduction Sales Co.
Wichita—Air Reduction Sales Co.

Electronic Timer

★ The preferred field of application of the Photovolt electronic timer is the timing of short intervals, such as a few seconds or fractions of a second, where timers incorporating clockwork or motors are mostly inaccurate. The operating principle is comparable to an hour glass: when the timer is actuated, a charged capacitor begins to discharge, the rate being controlled by an adjustable resistor. Simultaneously with the actuation, an amplifier tube energizes the relay. When the discharge of the capacitor is completed, the output current of the amplifier tube is cut off and the relay is de-energized.

The timing period can be adjusted by means of a control on the panel. The timer may be connected to the load outlet for "normally open" or "normally closed" operations as well as for powered or unpowered load, so that the requirements of practically all applications can be met by stock models.

The timer can be adjusted to open or to close a circuit for an interval of as short as 0.05 second or as long as 1/20 second. It can be operated on 100-130 volts a-c, any frequency and also on 100-130 volts d-c. After completing the timing period, it does not take more than 1/25 second for the timer to be ready again. This makes it suitable for fast re-cycling operations.



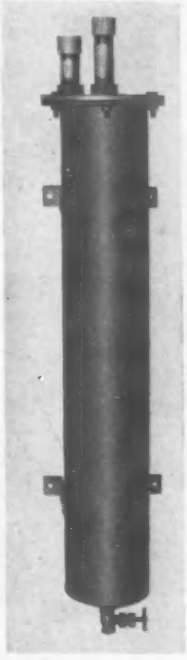
Photovolt electronic timer. An adjustable timing relay with immediate automatic resetting.

This device is designed so that two or more timers can be connected for operation in sequence. For this purpose, an additional outlet is provided on the panel to furnish an actuating impulse to a second timer. This outlet is a four-prong polarized male socket connected so that two of the prongs close an external circuit and are normally open while the others open an external circuit and are normally closed. **Photovolt Corp.**, 95 Madison, New York City 16.

» «

Chemical Dryer

★ "Gasflux" 636 dryer for removing moisture from air and gas lines was originally developed to remove moisture from generator acetylene used in conjunction with vaporized flux for oxy-acetylene welding or brazing applications. Basically, the dryer is a 6-in. OD outer shell of seamless steel tubing and a removable inner shell (cartridge) of rolled sheet metal with a perforated metal bottom. This shell holds the drying medium. A cast bronze head with inlet and outlet openings is bolted to a flange welded to the outer shell.



"Gasflux" 636 chemical drier. It removes most of the moisture in air and gas lines.

Incoming gas or air must first pass downward between the inner and outer shells, thus trapping entrained moisture. The gas then passes upward through the full length of the cartridge in order to reach the outlet valve.

A choice may be made of three drying media to be used in the cartridge: Fiberglas, calcium chloride and activated alumina. Each offers certain advantages. Fiberglas is a new material of mechanical action and is non-absorbent. It will remove all entrained moisture but not all of the water vapor. Calcium chloride absorbs 90% of its own weight in moisture and is at least 70% efficient. Activated alumina is 100% efficient but it will absorb only 12 to 14% of its own weight in water vapor.

The dryer may be bolted to a wall or may be suspended by pipe straps. It is only necessary to leave sufficient space overhead or below to allow the inner cartridge to be removed for replacement or servicing. **The Gasflux Co.**, 198 Wayne St., Mansfield, O.

BRIDGEPORT BRONZE

PUT THIS TIMING GEAR BACK TO WORK

Valuable time can be saved by putting broken machinery and equipment back to work quickly by brazing with Bridgeport Bronze Welding Rods.

Here is a typical example. Broken teeth on this large timing gear of a heading machine threatened to hold up operations. However, through the use of Bridgeport Bronze Welding Rod, the repaired teeth are standing up under severe usage.

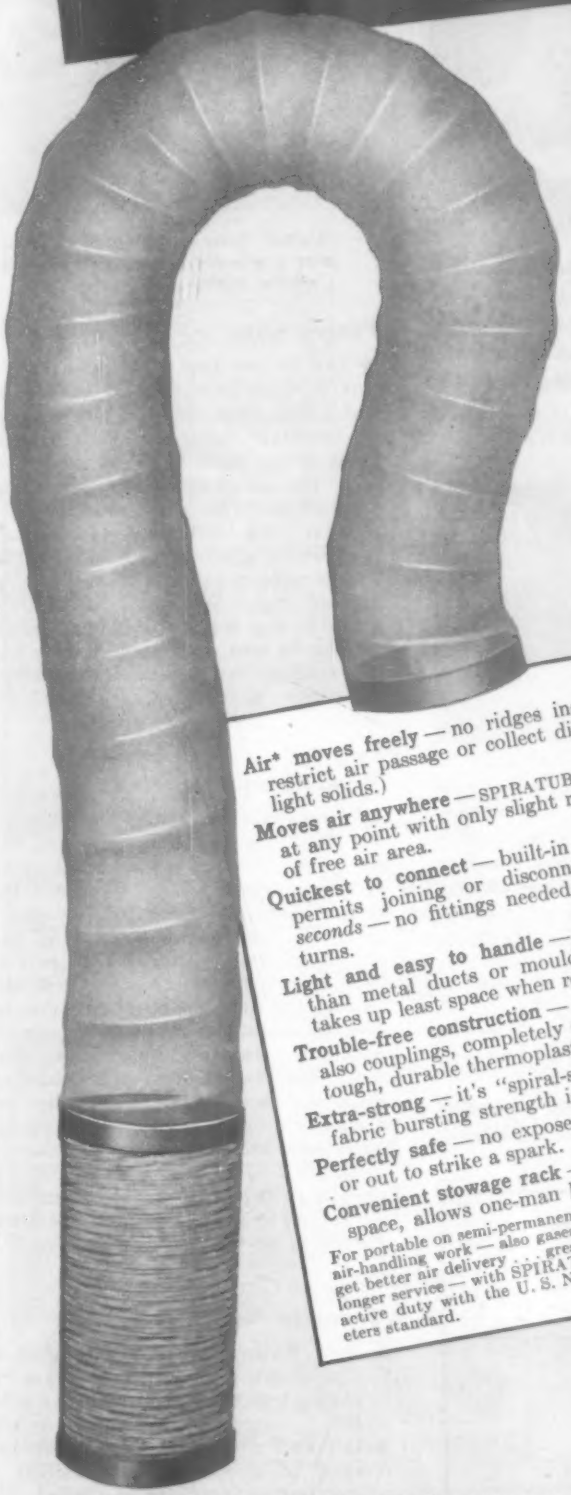
The gear was put back into service within a short time because preheating at high temperatures was not required. Minimize costly delays by brazing with Bridgeport Bronze and obtain strong, tough, dependable welds. For further information about these free flowing, strongly adhering bronze alloy rods, write on company stationery for your copy of "Bronze Welding Alloys."

"Bridgeport" BRIDGEPORT BRASS COMPANY
BRIDGEPORT 2, CONN. • Established 1865

Bronze Welding Rod A PRODUCT OF
BRIDGEPORT BRASS

EVERY ADVANTAGE YOU'D WANT IN...

Flexible Tubing



Air* moves freely — no ridges inside to restrict air passage or collect dirt. (*or light solids.)

Moves air anywhere — SPIRATUBE bends at any point with only slight reduction of free air area.

Quickest to connect — built-in coupling permits joining or disconnecting in *seconds* — no fittings needed for sharp turns.

Light and easy to handle — far lighter than metal ducts or moulded tubing; takes up least space when retracted.

Trouble-free construction — spring core, also couplings, completely covered with tough, durable thermoplastic.

Extra-strong — it's "spiral-stitched" . . . fabric bursting strength is 170 psi.

Perfectly safe — no exposed metal inside or out to strike a spark.

Convenient stowage rack — saves storage space, allows one-man handling.

For portable or semi-permanent ventilation or any air-handling work — also gases, light solids — you get better air delivery . . . greater convenience . . . longer service — with SPIRATUBE . . . proved in active duty with the U. S. Navy. 3" to 16" diameters standard.

NON-COLLAPSIBLE—RETRACTABLE

New construction principle. SPIRATUBE springs to work . . . stays extended . . . makes sharp turns . . . retracts to approximately ⅛ extended length . . . and gives you the exclusive features shown at left.

TROUBLE-FREE VENTILATION

Warner

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Gentlemen: I'm interested to learn more about SPIRATUBE. Please send specification folder.

Name.....

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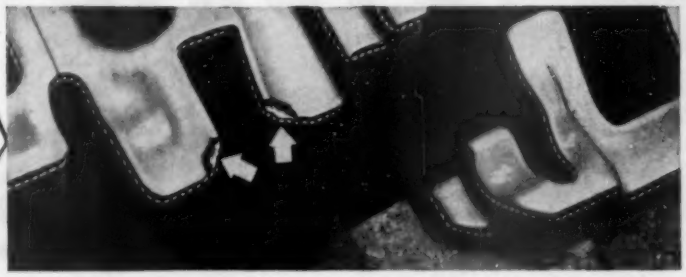
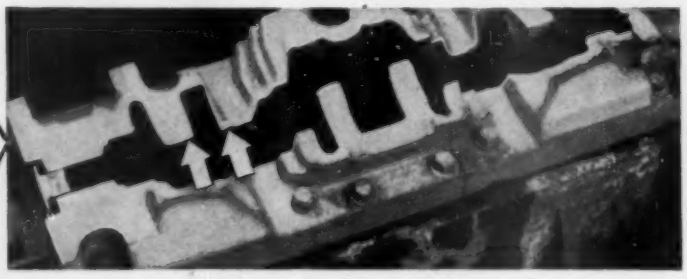
Quickly repair damaged dies ...by WELDING

HOW TIME IS SAVED



You realize huge savings when you repair damaged dies by welding because you *confine actual repairs to the immediate faulty areas only.* Dotted line in the illustration above indicates the ordinary time-consuming method of repair which necessitates reworking the entire area. You can repair virtually all types of tool steel by using the proper Eureka Tool Steel Welding Electrode. You can salvage or reclaim die units used for blanking, forming, forging, drawing, embossing, etc., etc.

NO HEAT TREATING

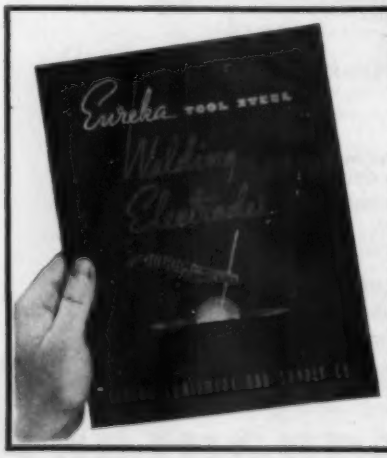


Weld deposits of Eureka Tool Steel Electrodes are, in most cases, "hard-as-welded," and subsequent heat treatment, other than tempering, is not necessary if the units lend themselves to grinding. Metallic arc welding with Eureka Tool Steel Electrodes retains dimensions within close limits. WRITE today *for your free copy of our 40-page Tool Steel Welding Manual, which graphically illustrates how welding can save you valuable man hours through repairing dies, composite fabricating, correcting design or rectifying errors.*

EUREKA Welding Equipment & Supply Co.

PIONEERS IN TOOL AND DIE WELDING ELECTRODES

223 LEIB STREET • FITZROY 3715 • DETROIT 7, MICHIGAN



FREE *Just clip and mail the coupon below for your free copy of our latest 40-page illustrated booklet, which will help you save many valuable man hours and minimize production delays.*

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"Sta-Set" finger cots. Freedom of movement is provided by the combination of pliable leather and elastic strap.

Finger Cots

★ One of two new AO "Sta-Set" finger cots is made from selected grain leather and is used wherever sensitivity of touch is an important factor—for such operations as soldering small wire, assembly work, etc. The second cot, made from chrome-tanned cowhide leather, is recommended for jobs involving hard usage—such as polishing, burring, grinding small parts, etc. Both cots provide protection for the front and back of fingers or thumb. They are designed to stay in place; it is practically impossible to turn or twist them, even under the roughest usage, states manufacturer. **American Optical Co.**, Southbridge, Mass.

» «

Metal-Cleaning Solvent

★ A new solvent cleaner, "Optimus solvent No. 2," is said to be quick and effective in the removal of grease, oil, carbon, grit and miscellaneous shop dirt from metal parts. Though compounded to give maximum cleaning strength, it will not harm metal surfaces nor operators' hands, says manufacturer. It will combine in kerosene or other hydro-carbon dilutent in order to remove dirt or grease by solvent cleaning action. Kerosene mixtures readily render physically clean surfaces suitable for further processing. In spray-type washing machine operations, the cleaner may be diluted at a ratio of 1 to 7 parts in fuel oil. A pressure of 20 psi has been found sufficient for spray cleaning. **The Optimus Detergents Co.**, 248 Church St., Matawan, N. J.

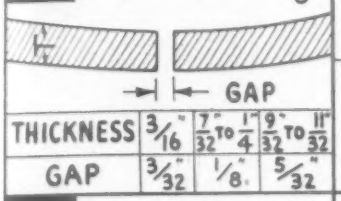
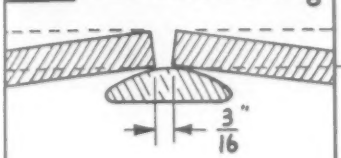
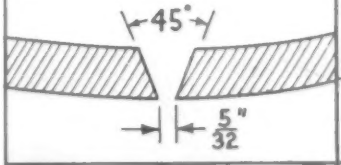
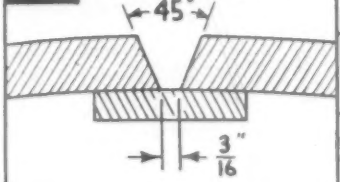
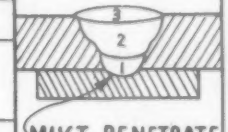
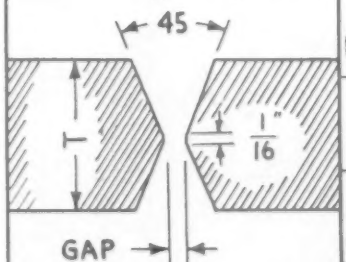
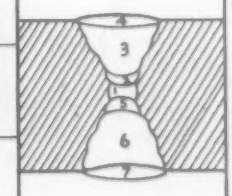
» «

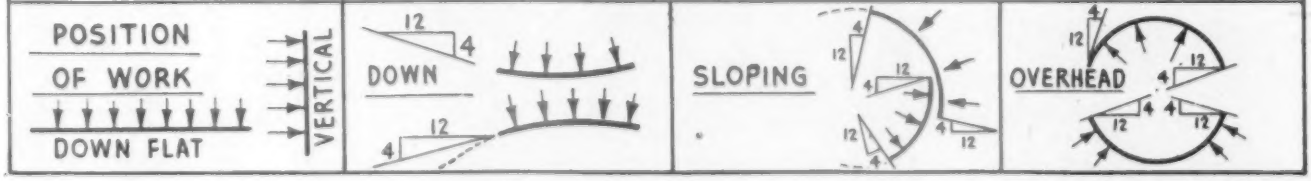
Magnetic Separator

★ The "Eriez" non-electric magnet offers a simple and efficient means for removing iron and steel trash and other ferrous materials from non-ferrous metals and alloys. It can also be submerged in circulatory oil systems to collect ferrous particles in the oil. The magnet has a working surface made entirely of stainless steel, and it is constructed of powerful magnetic Alnico alloy under General Electric patents. **Eriez Manufacturing Co.**, Erie, Pa.

(Please turn to page 81)

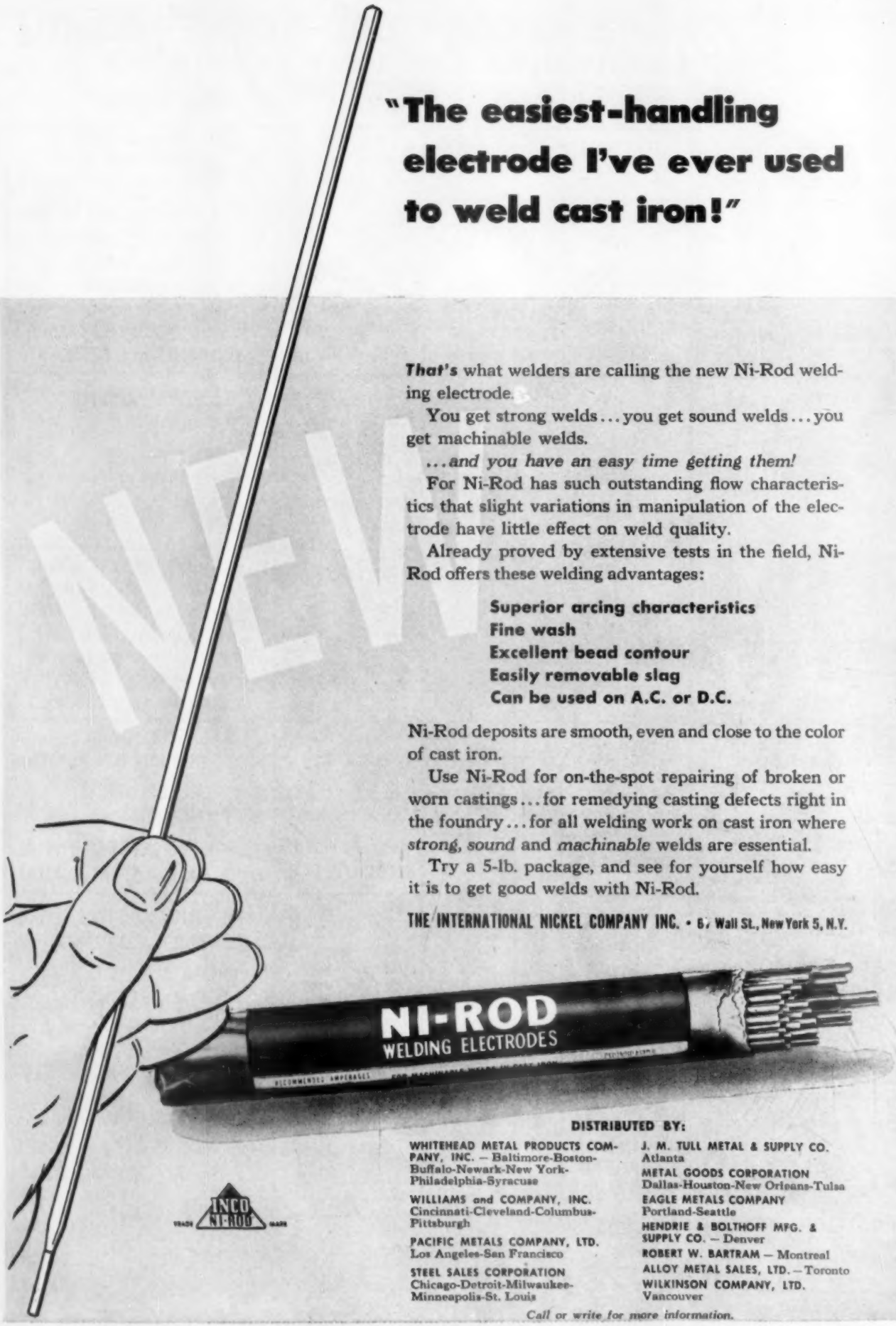
WELDING INSTRUCTIONS AND JOINT DETAILS FOR SPHERES AND SPHEROIDS

A.W.S. JOINT DESIGN C.B. & I. AND A.P.I.	POSITION OF WORK	WELD ROD 1ST PASS	WELD ROD BALANCE	WELD ROD STRINGER BEAD	NO. OF PASSES OR LAYERS	CHIPPING AND DIRECTION OF ELECTRODE TRAVEL
11 PLs LESS THAN 3/8"  THICKNESS: 3/16" | 7/32" TO 1/4" | 9/32" TO 11/32" — GAP: 3/32" | 1/8" | 5/32"	DOWN	5/32" 5	7/32" 5	3/16" V		① AND ② "DOUBLE PASS" METHOD ① DOWNHILL ② UPHILL ③ DOWNHILL – MAY BE SEVERAL PASSES ④ DOWNHILL CLEAN BETWEEN PASSES CHIP OUT ALL DEFECTS
	SLOPING	5/32" 5	3/16" V	3/16" V		
12 PLs LESS THAN 3/8" 	DOWN	3/16" V	3/16" V FOR UMBR. ROOF 1/4" 5		MUST PENETRATE BACKING UP STRIP	① BACKSTEP UPHILL ② DOWNHILL
	SLOPING	3/16" V	3/16" V			
13 PLs 3/8" TO 1 1/2" INCL. 	DOWN	5/32" 5	1/4" 5	3/16" V		① AND ② "DOUBLE PASS" METHOD ① DOWNHILL ② UPHILL ③ BACKSTEP UPHILL – MAY BE SEVERAL PASSES ④ DOWN ⑤ UP OR DOWN CLEAN BETWEEN PASSES CHIP OUT ALL DEFECTS
	SLOPING OR GIRTH	5/32" 5	3/16" V	3/16" V		
	OVERHEAD	5/32" 5	3/16" V	3/16" V		
14 PLs 3/16" TO 7/8" INCL. 	DOWN	5/32" 5	7/32" 5 FOR 3/16" PLs 1/4" 5		 MUST PENETRATE BACKING UP STRIP	① BACKSTEP UPHILL UP OR DOWN IN O.H. POSITION ② BACKSTEP UPHILL ③ DOWNHILL ② MAY BE SEVERAL PASSES WIRE BRUSH BETWEEN PASSES
	SLOPING OR GIRTH	5/32" 5	3/16" V			
	OVERHEAD	5/32" 5	5/32" 5			
15 PLs 1/2" TO 1 1/2" THICK  GAP = 5/32" FOR T LESS THAN 3/4" GAP = 3/16" FOR T = 3/4" OR MORE	BOTH SIDES DOWN LESS THAN 3/4"	WELD ROD 5/32" 5: ① ② ⑤	WELD ROD 3/16" V	WELD ROD 1/4" 5: ③ ④ ⑥ ⑦		① AND ② "DOUBLE PASS" METHOD ① DOWNHILL ② UPHILL ③ BACKSTEP UPHILL – AS MANY PASSES AS REQ'D. ④ DOWNHILL ⑤ UPHILL ⑥ BACKSTEP UPHILL – AS MANY PASSES AS REQ'D ⑦ DOWNHILL CLEAN BETWEEN PASSES CHIP OUT ALL DEFECTS
	DOWN 3/4" OR MORE		① ② ⑤	③ ④ ⑥ ⑦		
	SLOPING OR OVERHEAD LESS THAN 3/4"	① ② ⑤	③ ④ ⑥ ⑦			
	SLOPING OR OVERHEAD 3/4" OR MORE		ALL 3/16" V			



Courtesy, Chicago Bridge & Iron Co.

"The easiest-handling electrode I've ever used to weld cast iron!"



That's what welders are calling the new Ni-Rod welding electrode.

You get strong welds... you get sound welds... you get machinable welds.

...and you have an easy time getting them!

For Ni-Rod has such outstanding flow characteristics that slight variations in manipulation of the electrode have little effect on weld quality.

Already proved by extensive tests in the field, Ni-Rod offers these welding advantages:

Superior arcing characteristics
Fine wash
Excellent bead contour
Easily removable slag
Can be used on A.C. or D.C.

Ni-Rod deposits are smooth, even and close to the color of cast iron.

Use Ni-Rod for on-the-spot repairing of broken or worn castings... for remedying casting defects right in the foundry... for all welding work on cast iron where *strong, sound* and *machinable* welds are essential.

Try a 5-lb. package, and see for yourself how easy it is to get good welds with Ni-Rod.

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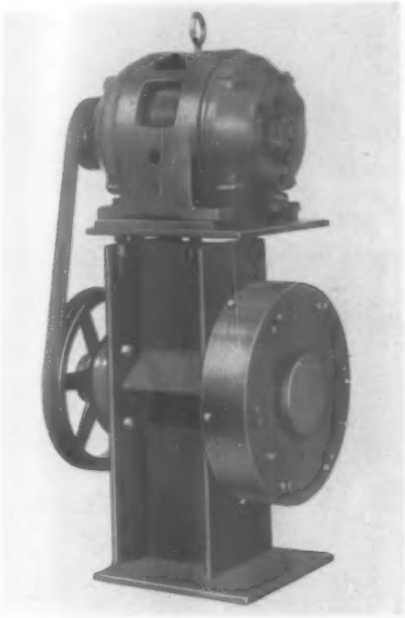
Call or write for more information.

New Products

(Continued from page 76)

Booster Pumps

★ A high-pressure booster pump said to give continuous trouble-free performance



Martin Wells model No. 6 booster pump for presses and other oil-operated machines.

at pressures up to 5,000 psi is available from **Martin Wells,** 5886 Compton Ave., Los Angeles1. This pump provides dependable and continuous service with high-pressure oil-operated machines such as presses for plastics, rubber, drawing, coining and bending. Model No. 6 pictured here delivers 6 quarts of oil per minute at 5,000 psi line pressure. It requires only four square feet for installation and weighs 300 lb. Other models are available in sizes up to 24 quarts.

» «

Small A-C Welder

★ "Zipper-et" is the trade name of a small portable a-c arc welder, especially recommended for light-duty welding, general maintenance and for the home work shop. Operating on 110-volt alternating current, it will handle all maintenance and repair work that does not require heavy-duty industrial welders of high amperage. It weighs approximately 40 lb, complete with all accessories.

The unit is contained in a heavy-gauge metal case having a carrying handle fastened at the top. The transformer is featured by spun-glass insulation and the fact that there is no electrical connection between the primary and secondary windings. The accessories include cables with insulated taper plugs and sockets, electrode holder, ground clamp, a supply of aluminum, brazing and steel electrodes and one of this manufacturer's "9000" arch torch. Each "Zipper-et" is also supplied with an approved welding helmet.

The welder will handle five electrode

"Zipper-et," the new portable arc welder for light welding and for the home work-shop.

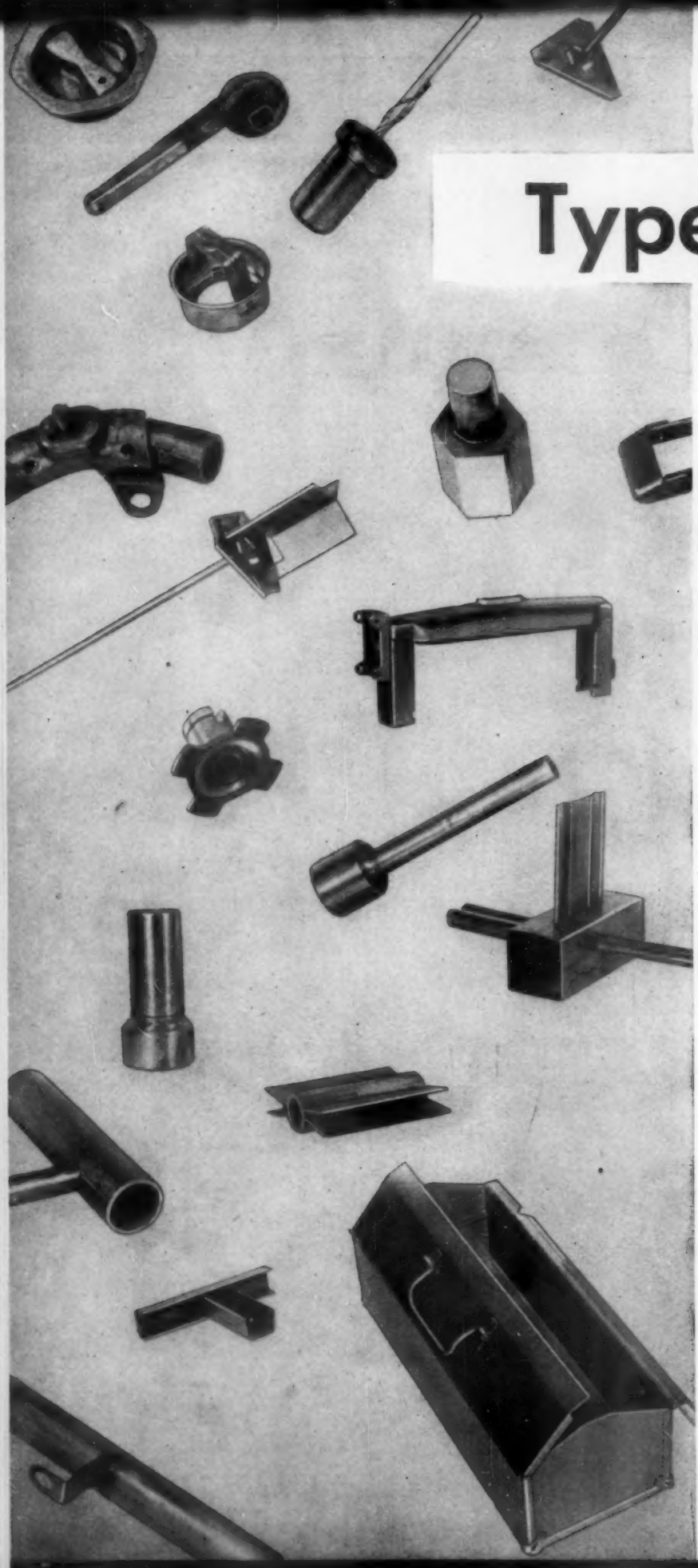
sizes ranging from 1/32 in. through and including 3/32 in. The arc torch will handle ¼-in. carbons. **Mid-States Equipment Corp.,** 2429 So. Michigan Ave., Chicago 16.

» «

Improved "Handy Hoister"

★ The "Handy Hoister" for lifting and transporting tools and raw materials has been improved by heavy-gauge steel construction of the bracket, backplate and platform and by a roller-bearing sheave on a hardened shaft, strong, channel-type uprights, tubular bracing, etc. **Lewis-Shepard Products Inc.,** 245 Walnut St., Watertown, Mass.

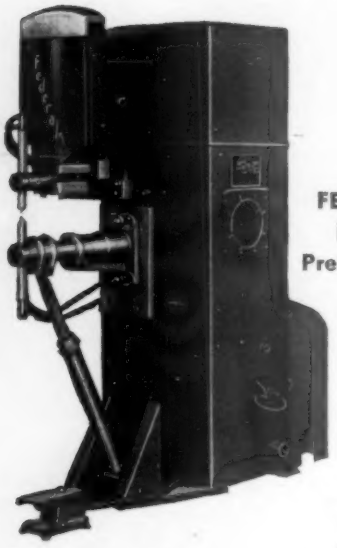
SAVE TIME USE A
CMD
WELDERS CHIPPING HAMMER
With steel or wooden handle. Light weight. Strong. Easy to use. Write for circular.
TYPES EB and FB
Models E and F can be supplied with brush as shown here. Brush can be replaced by unscrewing countersunk screw in bracket and removing.
TYPE F
Head has two chisels at right angles.
TYPE E
Head has drift and chisel.
TYPE A
Has drift and chisel. Widely used in malleable and grey iron foundries for general chipping.
TYPE CB
Combines 3 tools in 1—drift, chisel and removable wire brush.
TYPE C
Same as Type CB, but without brush.
CHICAGO MANUFACTURING AND DISTRIBUTING COMPANY
1928 WEST 46th ST., DEPT. W., CHICAGO 9, ILLINOIS



You Could

Types of Produ

Federal



FEDERAL PH-1 HYDRAULIC Press Type Welder

GET THIS BULLETIN

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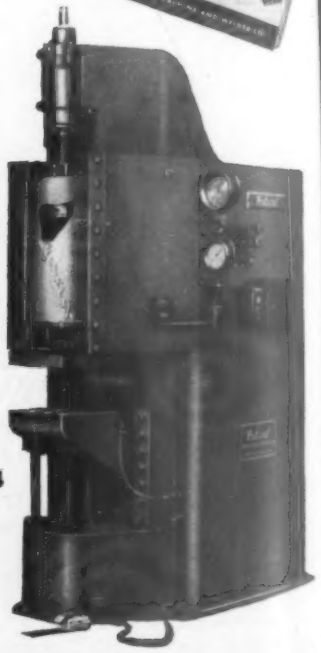


FEDERAL PH-4 HYDRAULIC Press Type Welder

Federal

MACHINE

Lincoln Diesel-engine-driven 300-amp d-c welder (stationary model). It can be mounted on a trailer to take to the job.

Diesel-Driven Welder

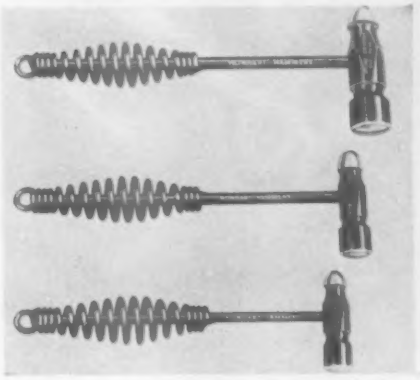
★ A new Diesel-engine-driven d-c welder of 300-amp capacity has been brought out by Lincoln Electric, for use in locations where electric power is not available or economical. Powered by a two-cycle Diesel engine, this unit is said to cut fuel costs up to as much as 86% from the fuel costs of gasoline-engine-driven welders. In many cases, total savings including fuel transportation, losses, etc. are as high as 40c per hour.

The welder is equipped with "Dual Continuous" control that permits the operator to select any type of arc or arc intensity to suit the job. The adjustment is said to make possible a wide range of application both as to thickness and as to classes of metals and alloys.

The welding generator has a NEMA rating of 300 amp at 40 volts. Current range for welding duty is from 20 to 40 volts, 60 to 375 amp. The generator is of the variable-voltage type and requires no external reactance or stabilizer.

The dual control of the welding current is accomplished by adjustment of both series and shunt fields. The generator can be adjusted in a continuous sequence of fine steps by means of the shunt field rheostat, or the current can be adjusted independently of the open-circuit voltage by means of the series field current control. Proper combination of these controls permits the operator to select any type of arc or arc intensity to suit the job.

Exciter and welding generator are electrically separate to improve welding performance and to reduce the upkeep costs. The generator frame is attached to the Diesel engine bell housing, and the generator shaft is connected to the engine flywheel by a special type of flexible coupling. The entire unit is mounted in a substantial channel frame. Complete, the welder (stationary model) weighs 2,560 lb and can be mounted on wheels, trailer or truck for transportation. Optional equipment includes spring-mounted running gear of the automobile-trailer type. **Lincoln Electric Co.**, Cleveland 1.



Atlas ball-peen hammers. The metal handles won't get out of alignment.

Ball-Peen Hammers

★ These new Atlas weld-cleaning hammers have heads of flame-hardened alloy tool steel and a "Flex-o Handgrip" shaped to fit the hand. The all-steel handle is unbreakable and will never come loose from hammer head. Hence heads will not fly off nor get out of alignment with hammer handle. Less muscular effort is required to use these hammers because of their balanced weight distribution. **Atlas Welding Accessories Co.**, 14824 Wyoming Ave., Detroit 21.

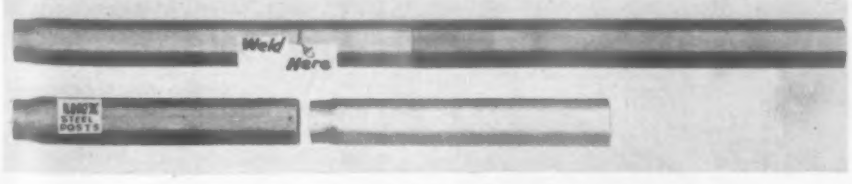
» «

Welded Steel Posts

★ "Linx" steel posts are 19½-in. sections of alloy steel tubing shaped so that each section rests on the shoulder support of the connecting unit (see illustration). They are then welded at the section to make the finished product. When fitted together, they make ideal posts, drain pipes, underground conduits, railings, supply racks, structural supports, etc. The sections are hollow, 2¼ in. in diameter, of hexagonal cross-section.

To support loads, the posts may be filled with concrete, which gives them the combined strength of ferro-concrete. Wood plugs to which wooden cross members may be nailed are available to insert in the top sections. Bolts, hooks, chains, screws, pipes, etc. for many purposes may be attached by drilling or tapping holes.

The sections are sold in standard packages of 20—equal to 30 lineal feet. The approximate shipping weight is 50 lb. Linx Steel Post sales division, **R-System Co.**, 1010 No. Clark St., Chicago 10.



"Linx" steel post sections are joined by welding as shown above.

"Forging Ahead in Business" is a practical, thoughtfully-written book with "punch" and common sense on every page. It carries a message of vital importance to every man who wants to make more money, get a better job and improve his station in life.

Partial Contents:

- Law of Success
- Forging a Career
- Organized Knowledge
- Highway of Achievement
- Making Decisions
- Failure and Success

Noted Contributors

Among the prominent men who have contributed to the Institute's training plan, which is described in "Forging Ahead in Business," are: Thomas J. Watson, President, International Business Machines Corp.; Clifton Slusser, Vice President, Goodyear Tire & Rubber Co.; Frederick W. Pickard, Vice President and Director, E. I. du Pont de Nemours & Co.

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Please mail me, without cost, a copy of the 64-page book—"FORGING AHEAD IN BUSINESS."

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Greyhound Model N115. One of two new a-c welders for farm service.

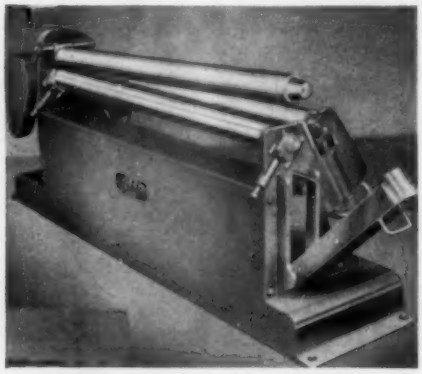
A-C Welders

★ Two portable a-c Greyhound welders have been announced for farm and service-station use. Both are featured by a built-in capacitor for high-power-factor correction; this not only meets REA requirements but also reduces power bills and installation costs, states manufacturer.

Model N115 (illustrated) has a new power-packed multiple-coil transformer with four coils instead of two, also a separate reactance. Welding range is from 15 to 115 amp.

Model NF180 has the same transformer as this manufacturer's variable-core-type, heavy-duty industrial models. Stepless amperage control is provided by a handwheel in a range of from 20 to 180 amp. **Greyhound A. C. Arc Welder Corp.**, 520-28 Morgan Ave., Brooklyn 22.

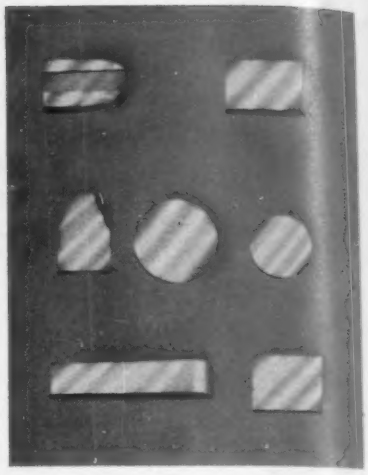
» «



Reed small bending roll. The "Series 400" will handle sheet steel in gauges from 10 to 18.

Plate-Bending Rolls

★ Reed "Series 400" rolls were designed primarily to meet the demand for small and inexpensive plate-bending rolls. There are four models: Model 438 with a working length of 38 in. and 10 to 12 gauge steel capacity, Model 450 with a 50 in. length and a 12 to 14 gauge capacity, Model 462 with a 62 in. length and a 14 to 16 in. gauge capacity and Model 474 with a 74 in. length and a 16 to 18 in. gauge capacity. Each unit is of all-steel welded construction. **Reed Engineering Co.**, P. O. Box 111, Webb City, Mo.

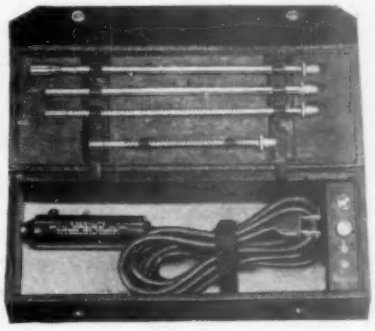


"Gibsiloy" silver tungsten electrical contacts. They provide increased conductivity.

Silver Tungsten Contacts

★ Electrical contacts made from silver tungsten and silver tungsten carbide are now available to engineers and manufacturers for incorporation in their postwar equipment. Advantages are: better conductivity, less likelihood of sticking, longer life. They are made from metal powders and comprise a range of combinations in the silver tungsten series from 10 to 80% tungsten, and in the silver tungsten carbide series from 20 to 80% tungsten carbide. **Gibson Electric Co.**, Frankstown Ave., Pittsburgh 22.

» «



"Eder-Lite" inspection lamp set for work where vision is difficult.

Inspection Light

★ A miniature inspection lamp, the "Eder-Lite," makes it possible to light up cylinders, gear housings, tubes, rifle barrels, pipes and other equipment that has openings as small as ¼ in. Power for the lamp is supplied through a small transformer enclosed in the handle. The metal-protected tungsten-filament bulb is attached to either a flexible or rigid extension. If desired, the lamp can be fastened to the back of the arm to provide clear vision in hard-to-get-at places, the user being protected against shock by the rubber-insulated wire cable and Bakelite transformer container.

The standard "Eder-Lite" set comes in a velvet-lined leatherette case and consists of the transformer handle, a ten-foot plug-in cord, two rigid and two flexible extensions of varying lengths and four sizes of miniature tungsten bulbs. **Harmon and Co.**, 6 N. Michigan Ave., Chicago 2.

Vise-Wrench
. . . THE TOOL OF A THOUSAND USES
Holds anything of any shape, securely—for drilling, welding, grinding, riveting, machining. Combines portability, convenience and simplicity of pliers with powerful gripping advantage of locked vise. Jaws are forged steel with milled teeth. All parts heat treated for extreme wear resistance. Ten inches long, jaw opening 1¼", weighs 18 ounces.
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THE CHAMPION
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CLEVELAND, OHIO
EAST CHICAGO, IND.

News of the Industry

RWMA Offers $2,000 in Prizes for Papers

A total of $2,000 in cash prizes will be awarded in 1946 by the Resistance welder Manufacturers Association for outstanding papers dealing with resistance-welding subjects. The contest judges will be appointed by the American Welding Society, and awards will be made at its 1946 fall meeting.

One prize of $750 is offered for the best paper emanating from an industrial source, consulting engineer, private or Government laboratory or the like. There are no restrictions on the scope of the subject matter. A prize of $500 will be given for the second best paper in the above classification, and a prize of $250 for the third best paper.

A prize of $300 is offered for the paper emanating from a university source—either an instructor, student or research fellow—which in the opinion of the board of awards represents the greatest original contribution to the advancement and use of resistance welding. A prize of $200 will be given for the second best paper from a university source.

The contest is open to anyone, without restriction, from the United States, its possessions and Canada. It is also open to any member of the American Welding Society in any grade from any place in the world. The contest is considered as having opened August 1, 1945, and will close on midnight, July 31, 1946. Papers entered in it should be sent to the American Welding Society, 33 W. 39th St., New York City 18. If mailed to arrive not later than July 1, three copies should be furnished. If mailed to arrive between July 1 and July 31, six copies should be furnished.

» «

Establish A. F. Davis Undergradute Award

To stimulate undergraduate interest in welding, A. F. Davis, vice-president of the Lincoln Electric Co., has donated funds for the A. F. Davis Undergraduate Welding Award. This will consist of four cash prizes totaling $700 to be presented annually to authors and publications for the best and second best articles on welding published in undergraduate magazines or papers during the preceding year. The author of the best paper and the publication in which it appears will each receive $200, and $150 each will go to the author of the second paper and to the publication.

Any undergraduate of a college, university or institute of technology in the United States or Canada is eligible. Judges selected by the Educational Committee of the American Welding Society will select the winning paper in July of each year on the basis of originality of the paper and the thoroughness with which the subject is covered.

Presentation of the first award will be made at the next annual AWS meeting in October, 1946.

» «

Airco Builds New Research Laboratory

Work has begun at New Providence, N. J., on the construction of a mechanical research laboratory for Air Reduction and its subsidiary companies. The laboratory will house Airco's apparatus research department, which is responsible for the development of processes and apparatus for using industrial gases and the electric arc, particularly in the cutting, welding and treating of metals.

The laboratory will have a floor area of 78,000 sq ft, the size of an average city block. Two small auxiliary service buildings will be adjacent. More than 150 engineers, metallurgists, physicists, chemists and laboratory technicians will be employed in the laboratory, as well as a number of instrument makers and skilled machinists for model making.

The buildings are of the latest ultra-modern, functional design, with all-welded steel frames, reinforced-concrete foundations and floors, and brick walls with continuous steel-sash windows. Interior features are welded pipe lines for the distribution of oxygen, acetylene, nitrogen and other industrial gases, especially constructed rooms for experiments in the combustion of gases and the processing of metals, fluorescent lighting fixtures and movable steel partitions to permit maximum flexibility of interior working space. A technical library will be provided and also an historical exhibit of welding and cutting equipment dating back to the turn of the century.

» «

Linde to Expand Boise Facilities

Plans for a new oxygen-filling station and acetylene-producing plant, to be located at Centre Ave. near Owyhee St., Boise, Idaho, have been announced by The Linde Air Products Co.

Develop Alloy to Take Turbine's Temperature

The gas turbine has been forced by General Electric engineers to take its own temperature through use of a special chrome-cobalt alloy. This alloy, which should have many other applications in the fabrication of metals, shows a marked color change for every 25 degree change in temperature from 500 C to 700 C. It then reverts back to its original color and begins the color scale over again in a higher range from 725 C to 900 C (1,652 F).

The temperature-taking alloy, like most metals, changes color when it is being oxidized under heat. Unlike other metals, however, this alloy oxidizes so slowly at higher temperatures that each color change occurs regularly at 25 degree intervals, thus permitting an actual graduated color scale.

On the basis of a one-hour heat treatment, the alloy at 500 C turns a light straw color, at 525 a straw color, at 550 a bronze color, at 575 purple, at 600 dark blue. It turns light blue at 700 C and should next, according to all precedent, turn grey, indicating the end of the color scale. Instead, however, it does the unusual and reverts back to a light straw color to begin the progression of colors all over again. It does begin to show graying tendencies at 925 C, the engineers report, and is then no longer useful as a yardstick for measuring temperature.

» «

Greyhound A.C. Arc Welder to Move to Own Building

Greyhound A. C. Arc Welder Corp. is completing erection of a new one-story building, approximately 50 by 135 ft, on a tract of land recently purchased at 604-606 Johnson Ave., Brooklyn 6. The company expects to move to its new quarters on or about March first. About twice the former amount of space will be available for the manufacture of Greyhound arc welders and related equipment.

» «

Midwest Power Conference in Chicago April 3-5

After a year's lapse due to the war, the Midwest Power Conference will again be held in Chicago, on April 3, 4 and 5, under the sponsorship of the Illinois Institute of Technology. Coöperating in the sponsorship are nine midwestern colleges and universities and several engineering societies, including The Western Society of Engineers.

Preliminary plans for the conference include a session on the gas turbine and a discussion of atomic energy in the postwar power world. Other highlights of the three-day session will be an "All-Engineers" dinner and joint luncheons with the American Society of Mechanical Engineers and the American Institute of Electrical Engineers.

A *New* Resinoid Wheel for Weld Grinding

B-5

B-5 is the designation for a new and improved Norton resinoid bond for wheels in the soft and medium hard range. In shop after shop it is proving outstanding for weld grinding jobs of all kinds.

Operators like the fast, smooth cutting action of the Norton B-5 Resinoid Wheel and the way it hugs the work. Management likes the way it cuts costs—because of its faster cutting action and longer life.

It will definitely pay you to try the Norton B-5. Get in touch with your Norton abrasive engineer or Norton distributor.

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W-1029

NORTON ABRASIVES

WELDING

MODERN STEELS

BY

MODERN METHODS

DEMANDS...

. . . PRECISION CONTROL OF

HEAT!

Precision control of Preheating for Welding and Normalizing after welding is the only efficient method for joining modern alloy steels. Induction Heating by the Smith-Dolan System, PLUS the new Heat-Cycle Program Control gives all this — **and more!**

MODERN—SELF-OPERATING—COMPLETE!

Once the metallurgical heat-cycle for the steel has been determined, it is only necessary to set the controls, and the machine shown above will deliver this program from start to finish! In addition, recorded charts keep permanent records for duplication of results. A complete unit for efficient performance. Temperatures up to 1750° F. readily obtainable.

ELECTRIC ARC, Inc.

152-158 Jelliff Ave. **Newark 8, New Jersey**

Federal Welder Co. Buys Three Plants

In accordance with its broad postwar "new goods" program, The Federal Machine and Welder Co., Warren, O., has purchased three manufacturing organizations in widely diversified fields. These are the Warren City Manufacturing Co., Warren, the Sommer and Adams Co., Cleveland, and the Helene Curtis Chrome Co., Chicago.

Federal has purchased all of the stock of the Warren City Mfg. Co. from Graham-Paige, which intends in the future to concentrate its manufacturing at the Willow Run plant.

Sommer and Adams, builder of a variety of special machine tools for the automotive and aviation industries, will be operated as a Federal subsidiary, with executive management centered at Warren. Production will continue in Cleveland.

The Helene Curtiss Chrome Company's line of chrome furniture and fixtures, widely known in the beauty parlor field, will continue to be manufactured by Federal.

» «

Plans for Site-Welded Steel Farm Buildings

Many new peacetime welding jobs to employ workers at their war-learned craft are in sight as a result of research in the construction of steel-frame farm buildings conducted on a long-time-basis by the University of Wisconsin, Madison, through a grant by Carnegie-Illinois Steel Corp. One of the objectives of this research was to develop plans for low-cost barns, silos, cribs, dairy, poultry and other farms buildings which may be quickly erected by welding the structural members together on the site.

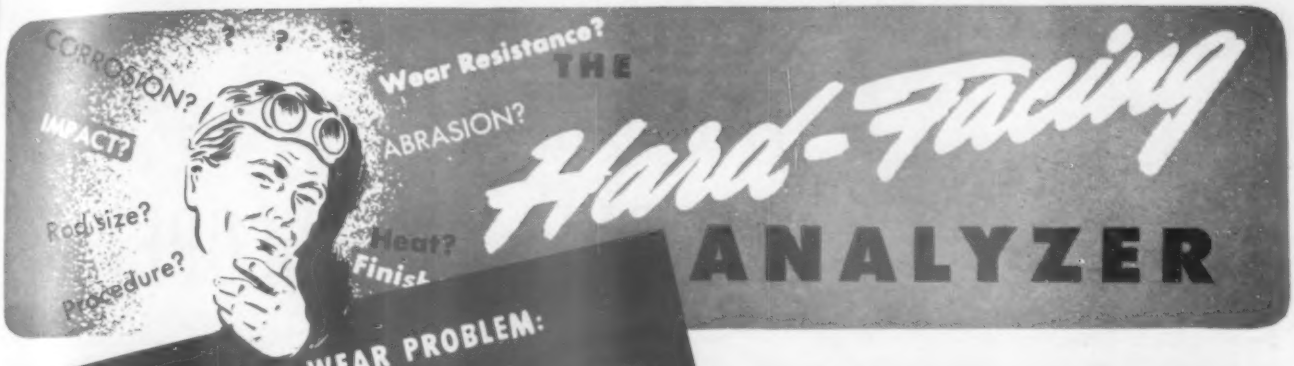
Through Carnegie-Illinois Steel Corporation's plan service, pilot plans for many different types of site-welded farm buildings will be made available to building supply dealers, welding shops and local builders. These plans propose steel framing for large farm buildings having clear spans upward from 24 ft. Smaller buildings may be prefabricated more economically of sheet steel or else framed of other types of building material.

» «

Distributor Changes Name

The Van Horn distributing organization operating in Louisiana and Texas will in the future be known as the Oliver H. Van Horn Co., Inc. Headquarters are at 1742 St. Charles Ave., New Orleans 1, and branch offices are located at Houston and Fort Worth, Tex., and Shreveport, La. The New Orleans office was formerly known as Van Horn & Son Inc., while the three branches operated as Oliver H. Van Horn Co., Inc.

The same officers continue; namely, Oliver H. Van Horn, president; Hobart Van Horn, vice-president, and John A. MacIaren, secretary-treasurer.



THIS MONTH'S WEAR PROBLEM:

DREDGE CUTTERS

Selecting the proper hard-facing alloy for any job must always be based upon operating conditions which vary infinitely between applications. Here are operating conditions imposed upon DREDGE CUTTERS:

SEVERE EROSION of water and silt against cutters.

IMPACT AGAINST submerged debris.

EFFICIENCY of all cutting edges rapidly deteriorates as wear destroys sharpness. Dredge cutters are no exception. Erosion of silt in water, which moves past cutters at high velocity, plus continued collision with gravel and submerged debris, greatly limits useful life of cutters and causes considerable downtime for cutter changes. Furthermore, as cutting edges become dull, their thickness increases with additional loss of digging efficiency.

To increase wear resistance, teeth and blades are now protected with Tube Borium. Not only is 300 to 400 per cent longer dredge cutter life obtained, but cutting edges *are self-sharpening*. Deposits of Tube Borium may be reapplied as required.

Of all hard-facing alloy types, Tube Borium is *first* in wear resistance. Graded particles of tungsten carbide, the hardest and longest wearing of all man-made metals, are encased in mild steel tubes. When applied, the molten tubing forms a solid matrix surrounding each carbide particle and produces an almost abrasion-proof surface. 3/16" Tube Borium is available for either electric arc or oxy-acetylene application. Priced at $3.15 per lb., f.o.b. Whittier, Calif., or distributors' warehouses.

APPLICATION Electric Tube Borium is applied on leading faces of blades and cutter teeth. Dismantling of the cutter head from the dredge is unnecessary. Inspect periodically and re-hard-face as wear occurs.

STOODY COMPANY

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STOODY HARD-FACING ALLOYS

Retard Wear **Save Repair**

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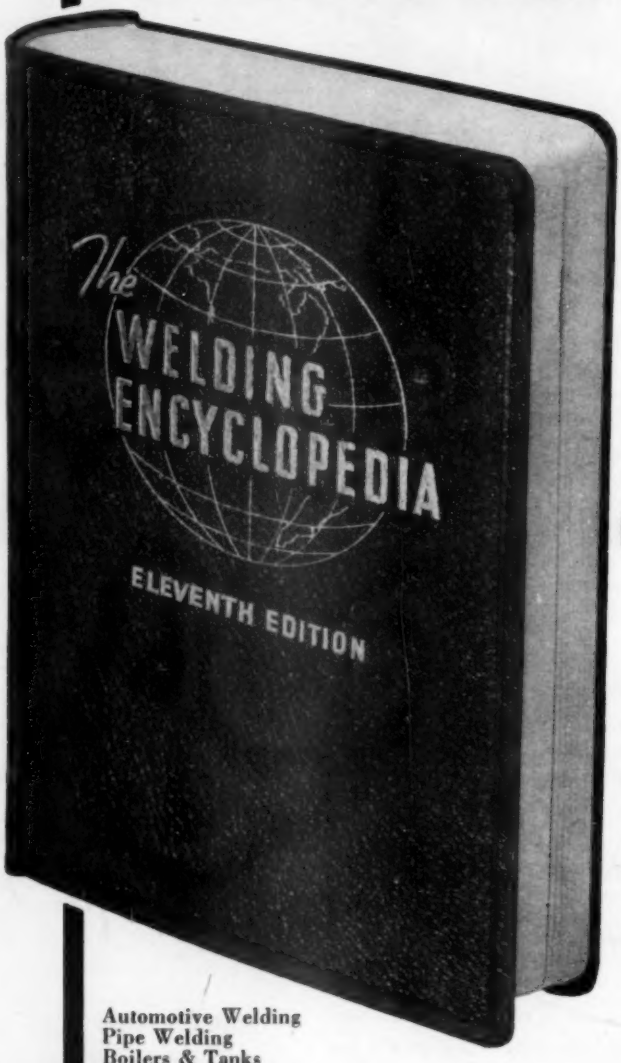
The 11th Edition of The Welding Encyclopedia comes to you completely re-written—reflecting the tremendous changes in welding wrought by the production necessities of American Industry at war. In its 22 years of service to the Welding Industry no single edition of The Welding Encyclopedia has presented so much completely new and vital information on welding practice. Edited and rewritten by T. B. Jefferson, leading technical editor and engineer, this complete reference book is a *must* on the list of every engineer and weldor.



One of the greatest values ever presented by a major reference book—980 pages of current authoritative information with 1359 illustrations on the world's most important and fast developing industrial process — Welding.

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The 11th Edition is a 25% larger volume—completely re-written. It is rearranged with easy-to-find cross-references and contains 1359 illustrations in its 980 pages. It brings to you, in its added size, a complete compilation of exhaustive research keyed to the demands of Industry's fastest growing fabricating process. It contains compact authoritative data—much of which can be found only in The Welding Encyclopedia, 11th Edition.

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INFORMATION ON WELDING

Ex-G.I.'s Fine Weldors Declares School Head

Six months ago, when the speedy return of our soldiers, sailors and marines began actually to materialize, there was much concern as to how these boys would fit into civilian activities and into peacetime jobs. In particular, there was a great amount of pessimism expressed with regard to the problem of handling the veterans, of helping them to become again fit for normal living. Vociferous psychologists, with more clamor than judgment, led us to believe that these ex-fighting men would be nervous, impatient, erratic, unreasonable.

The truth is far otherwise, according to Ed Scott, president of the Cleveland School of Welding. "At our school," he says, "all these warnings led us to expect that if we enrolled any of these returned veterans under the G. I. 346 Bill or the G.I. 16 Bill, they would mostly turn out to be problem students. But we enrolled them, a lot of them, as fast as they applied, and the things we had expected to happen simply did not occur.

"Right now we have over 30 of these men in training. No finer group in morale and in aptitude has ever attended our school. Their attendance record is the best we have seen in the 20 years that we have been operating. Furthermore, they learn well, and industry can look forward to getting some good weldors from this group."

» «

Chicago to Stage Production Conference

"Production for Profit" will be the theme of the Chicago Production Show to be held March 20, 21 and 22 at the Stevens Hotel under sponsorship of the Chicago Technical Societies Council. The latter body represents 46 scientific, engineering and technological societies, including the American Welding Society, with a combined membership of more than 17,000.

In addition to society members, thousands of production men from factories of the middle west will journey Chicagoward to view the results of wartime advances in production tools, materials, handling devices, control instruments and factory equipment in general. Manufacturers desiring information should get in touch with Paul A. Jenkins, executive secretary, Chicago Technical Societies Council, 53 W. Jackson Blvd., Chicago 4.

» «

Precision Welder in Larger Quarters

Precision Welder and Machine Co. has moved to its own building at 138 East McMicken Ave., Cincinnati, to obtain increased floor space. The building contains 25,000 sq ft of floor space to be used for the manufacture of spot, projection, seam, and flash-butt welding equipment. Only 7,500 sq ft of floor space were available at the previous location at English and Neave Sts., Cincinnati.

For a better working point— For more welds per rod

HOLD-ARK ELECTRODES

SPEER Hold-Ark Electrodes consume slowly. In competitive tests, they have lasted up to 30% longer than the best carbon electrodes previously available . . .

Hold-Ark Electrodes have *higher density* — give you a more concentrated burning point that produces a steady penetrating arc of high heat value. Their angle of burning is short and does not extend far back on the rod. There's no spindling — all of the rod is burned in useful work. Hold-Ark Electrodes can be used right down to the holder.

For longer electrode life — more welds per rod in hand or automatic welding — specify SPEER *Hold-Ark* Electrodes.

596

CHICAGO • CLEVELAND • DETROIT
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SPEER
CARBON COMPANY
ST. MARYS, PA.

New Process Developed to Mould Molybdenum

Westinghouse engineers have developed a new process that removes the restrictions of both size and shape on the production of molybdenum. Furthermore, the cost per pound has been reduced to roughly one third. Oddly enough, this feat of major significance in the metallurgical world was accomplished in the company's Bloomfield, N. J., plant devoted to the manufacture of lamps and electronic tubes.

The qualities of moly that have seemed so long attractive to designers have been the very ones to block its production in large sizes and complex shapes. Moly melts at 4,748 F as compared to iron at 2,800 F and copper at 1,976 F. Thus, pure moly cannot be melted like other metals to form large solid pieces because any container or crucible of known materials would melt first. In the past, therefore, molybdenum pieces had to be made by compacting moly powder into the desired shape under great pressure and then passing a high current through the piece to bring its temperature up to just below the melting point so that the particles would adhere to each other.

The new Westinghouse process is said to permit the piece to have any desired shape that can be molded. It can be round, square, with fins or angles, or with holes.

WELDING
Reaches New Horizons...
with
MARQUETTE
REGISTERED U.S. PAT. OFFICE
A.C. ARC WELDERS
Marquette has done it again! Look at the outstanding features in these New Model Marquette Welders. Model 262 C has built-in capacitor for high power factor. Larger reactance transformer for improved welding characteristics. Improved voltage ratios for faster arc striking. Telnic Bronze (new copper-nickel alloy) plugs and sockets in high amperage heat stages doubles current carrying capacity. Front panel designed for greater convenience. Generous use of new aluminum alloys reduce eddy current losses and increase transformer efficiency. Larger wheels and truck mounting for easy mobility. All Marquette Welders are fully equipped with no extras to buy. Ranges: Model 261 and 261 C, 20-200 amperes; Model 262 and 262 C, 20-275 amperes.
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MARQUETTE WELDING EQUIPMENT SOLD EXCLUSIVELY
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How Good Is Today's Worker? Ford Asks

Despite prevailing belief to the contrary, the recent record of productivity is not encouraging, declared Henry Ford II, president of the Ford Motor Co., in a recent address before the annual meeting of the Society of Automotive Engineers.

The production trend per worker has not been onward and upward but down, Mr. Ford pointed out. He said in part:

"One group of operations which took 96 minutes in 1940 took 128 minutes five years later. Another group which took 1,188 minutes in 1940 took a total of 1,943 minutes to perform five years later. A third group took 28 minutes in 1940 and 49 minutes five years later.

"On the whole, productivity per worker in our plants declined more than 34% during the war period. Some of this was inevitable, a result of the war, and I should like to say that I am emphasizing these figures merely to demonstrate how great is the need for improvement in this field."

» «

Progressive Welder Expands Floor Space

In anticipation of a increased demand for resistance-welding equipment for peacetime products, Progressive Welder Co., 3050 East Outer Drive, Detroit 12, is expanding its plant floor space by approximately 50%. This represents the second major plant expansion in two years.

The new facilities include an adjacent factory and about 10,000 sq ft of new construction joining the two buildings. One section of the new plant will be taken over by the company's research and development division for current projects of new process development and application testing. The remainder of the plant will be given over to production capacity.

» «

Abrasive Manufacturer Changes Company Name

The corporate name of the Abrasive Co. of Philadelphia has been changed to the Simonds Abrasive Co. This company is a division of the Simonds Saw and Steel Co., which purchased it in 1927. Its main office and works are at Tacony and Fraley streets, Philadelphia.

» «

University of Texas Gets Mabry Ordnance Equipment

The Mabry Ordnance Shop at Austin, Tex., which gained its fame through handicapped veteran labor made possible by weldors who shaped tools for one-armed men (see page 51, October WELDING ENGINEER) has been inactivated, but its commanding officer, Col. James W. Dewberry, has seen to it that its spirit will live on in coming generations.

Five hundred thousand dollars worth of machinery, tools and other equipment from the shop has been given to the University of Texas, in Austin.

Produce Sound-Film on Wet-Belt Grinding

A 16 mm sound film titled "A Machine of the Age" traces the development and perfection of wet-belt grinding from its earliest dry-belt forerunners to its acceptance as a machine tool used on production orders running into hundreds of thousands of pieces.

The film shows how surfacing, grinding and stock-removal operations are performed. Technical information is given on the amount of stock removable, kind of finish attainable and tolerances held on various materials. Some of the operations pictured are: removing risers, flashings and parting lines from cast materials; surfacing large, flat areas to close tolerance; chamfering, edging, squaring, rounding and cutting radii on single-piece operations.

The film may be obtained for private or group showing from the Porter-Cable Machine Co., 1714 No. Salina St., Syracuse, New York. Its running time is 11 minutes.

» «

Market for 13,000,000 Autos, Survey Reveals

Automobile production represents one of today's greatest opportunities for welding, particularly in the resistance-welding field. An estimated 13,114,820 passenger automobiles are indicated as the possible market by a recent consumer survey conducted by Frank Mansfield, director of sales research for Sylvania Electric Products Inc. It was found that 41.8% of all people interviewed intend to buy a car in the coming year.

Broken down into different family-income groups, the survey shows that there is a market for 1,246,200 cars to families with annual incomes of $5,000 or more; 2,538,900 for those with $3,000 to $5,000; 6,443,000 for those with $1,000 to $3,000; and 2,886,720 for those with incomes of less than $1,000.

» «

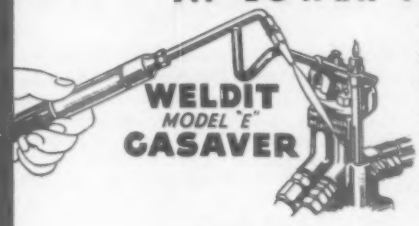
Correction

We are sorry that an error occurred in the article, "Fabricated Steam Platens," page 39, December, 1945, WELDING ENGINEER. One sentence read: "The elimination of leaks makes the application of these platens desirable for circulating cooling media which operate at temperatures of 700 F or higher." This, of course, is nonsense. The last part of the sentence was intended to read: ". . . platens desirable for circulating cooling media well below zero or heating media which operate at 700 F or higher."

We are advised that size limitations have been adopted by Lukens Steel Co. since this article appeared. While plates can be rolled up to the capacity of the 206-in. mill, the maximum size of an individual rolled platen has been set at 110 in. long by 60 in. wide by 5 in. thick. Several platens, of course, can be welded together to make almost any size.—*The Editors.*

Safe Welding

AT LOWER PRODUCTION COSTS



The Weldit Gasaver shuts off the welding flame when not in use. . . . Conserves essential materials by cutting oxygen and acetylene consumption as much as *fifty* per cent. Prevents injury to workmen—or sudden fires—from dangerous idle torch flames. . . . Adjustment remains unaltered between welds.

When the Weldit Gasaver has been installed, you simply hang idle torch on the handy lever rod. Weight of torch pulls rod down, thus automatically shutting off supply lines. Relight instantly by passing torch over Gasaver pilot light. No bother. . . . No time lost. . . . *No readjusting required.* . . . Price $10.00 at Detroit. Order today.

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The Weldit Model CW Blowpipe is in daily use by many foremost industrial plants. . . . Built in accordance with the recommendations of leading fabricators of sheet metal products. . . . Operates on either natural gas, manufactured gas, or other low temperature fuel gas and compressed air. Stands up under rough shop use. . . . Send for literature.

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For better, faster welding, easy-to-operate TRINDL SUPER INDUSTRIAL ARC WELDERS will help step up your production schedules 20% to 40%. Manufactured in a range of distinctive sizes to accommodate every type of shop and production welding job.

Trindl Welders, Electrodes, supplies and accessories, available for immediate delivery, will save you both time and money. Write, wire or phone for full details.

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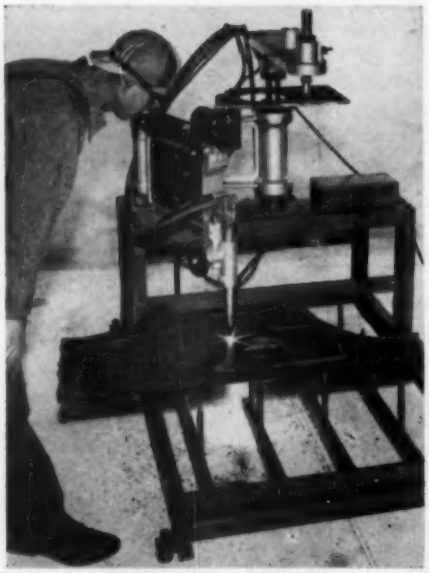
BETTER SHAPE CUTTING



At last you can have a flame cutting machine which is completely unitized. No extra tables or fixtures are required. The machine is ready to go to work at once. Templet making is no longer a problem. Either plywood or metal templets may be used. The OMW is designed to automatically cut an unlimited variety of shapes and any part which falls within its 30" x 65" range can be cut quickly and to close tolerances. Circles up to 30" in diameter can be cut. Automatic reproduction from steel templets has been made simple and easy by magnetic control. Master steel templets may be flame cut easily by the machine from a plywood templet.

SPECIFICATIONS

Overall Dimensions	36"x60"x58" high
Circle Cutting Range	0"—30"
Straight Line Cutting	65"
Cutting Speed Per Minute	3"—30"
Electrical Requirements	115V—AC or DC
Net Weight with Semi-Stationary Base	534#
Net Weight with Portable Base	347#

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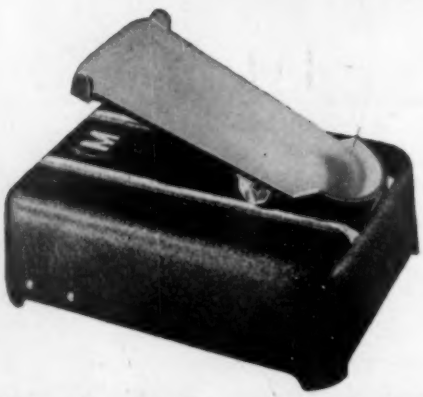
LESS FATIGUE

SAVES LABOR



"Arctrol" regulates the generator output from full-rated current down to snuffing it out completely. It permits the welder to adjust the current for varying thicknesses of metal and for different welding positions . . . merely by moving the foot pedal. Craters are eliminated by "snuffing" out the current as the weld is completed.

Ask your Welding Supply Jobber or write for Data Sheets and Prices.
Specify welding equipment you use.

MULLENBACH ELECTRICAL MFG. CO.

2300 E. 27TH ST. LOS ANGELES 11 CALIFORNIA

Burdett Oxygen Opens Retail Welding Store

Burdett Oxygen Co., Cleveland, is taking reconversion steps in the direction of customer service by opening a city service store at the corner of Lakeside Avenue and E. 33rd.

The new "Burdox City Service Store" will be one of the first establishments of its kind in northern Ohio. It will carry in stock a full line of gas welding and cutting outfits, torches, regulators, rod, cable, hose, lighters, cylinder trucks, connections, fluxes, goggles, helmets, face shields, gloves, respirators, lenses and similar safety equipment. A complete line of arc-welding equipment and accessories will be offered.

The new Burdett store is modern in every respect. An all-glass front presents brightly labelled merchandise to the eyes of passers-by. Glass showcases carry merchandise, which is accessible to the customer's handling and inspection. Rows of bins are built from floor to ceiling to hold the hundreds of different welding and cutting products and safety equipment.

Following a company policy of assigning men trained in engineering to sales activities, Burdett will staff the establishment with men from its sales engineering department. Free consultations for customers will be a regular store policy.

» «

Four Awards Presented by Society for Metals

Four important awards for metal-industry achievements were to be made by the American Society for Metals during its convention in conjunction with the 27th National Metal Congress and Exposition in Cleveland, February 4 through 8. These were to go to: Gerard Swope, General Electric Co., New York City; Earle C. Smith, chief metallurgist, Republic Steel Corp., Cleveland; Robert S. Archer, metallurgical assistant to the vice-president, Climax Molybdenum Co., New York City; and Dara P. Antia, Stewart G. Fletcher and Morris Cohen, the department of metallurgy, Massachusetts Institute of Technology, Cambridge, Mass.

» «

New Distributors

Eccles & Davies Machinery Co., Inc., 1910 Santa Fe Ave., Los Angeles 21: The E. J. MacDonald Co. (successor to Bergstrom Alloys), 805 West Fourth St., Reno, Nevada and Eastern California distributor for Edco phosphor-bronze electrodes.

» «

Lloyd S. Johnson Co., 2241 Indiana Ave., Chicago 16: Welding Equipment and Supply Co., 223 Leib St., Detroit 7, to handle the "Aluminaweld" and "Lloyd's" lines of solders and fluxes.

ABOUT PEOPLE

After years of loyal and able service, **E. A. Daniels,** and **E. O. Williams,** have been elected vice-presidents of Victor Equipment Co., San Francisco. Ernie Daniels, formerly general sales manager, becomes vice-president in charge of sales, while Ed Williams, formerly district manager, Los Angeles, becomes vice-president and manager of the Southern California district.

» «

Lincoln Electric Co., Cleveland, has added the following district office representatives who will all serve in the capacity of welding engineer: **Omer W. Blodgett,** Grand Rapids, Mich.; **Frank Boucher,** Detroit; **R. K. Kewley,** Cleveland; **G. B. Moseley,** St. Louis; **Captain L. J. Cogan** (recently released from the United States Army), Philadelphia.

» «

P. D. Scott, formerly with the Welding Equipment and Supply Co., Detroit, is now manager of the tool-steel division of Alloy Rods Co., York, Pa.

» «

W. L. Immer, is now assistant manager of the newly reorganized welding division of the General Electric Co., Schenectady. Other changes include the appointments of: **W. W. Churchill** in charge of the equipment group; **H. O. Westendarp, Jr.,** to head the electrode group; **B. C. Tracey** in charge of the accessory group, and **R. F. Wyer** in charge of the engineering group.

» «

Fred T. H. Youngman, formerly executive vice-president of the Jessop Steel Co., Washington, Pa., has been elected president. He succeeds **R. Edison Emery,** who was made chairman of the board. Three new directors have been added to the Jessop board of directors: **W. C. Buchanan,** president of the Globe Steel Tubes Co., Milwaukee; **Andrew J. Dallstream,** senior partner, Pam, Hurd and Reichmann, Chicago; and **Linwood A. Miller,** Chicago, formerly president of Willys-Overland Motors.

» «

Frank E. Hilgemeier, has been appointed sales manager of the Hampton Electric Manufacturing Co., New Kensington, Pa.

» «

Clarence L. Smith, has been appointed Detroit district manager of the grinding machine division of the Norton Co., Worcester, Mass. Before the outbreak of the war Mr. Smith spent over a year in Europe on special grinding machine sales engineering work. He succeeds **Oscar A. Knight,** who retires after forty years with the company.

Jerry French, formerly the publisher of the Merchandise Mart *Review,* has been appointed public relations director for the Rego division of The Bastian-Blessing Co., Chicago.

» «

Eugene W. Shafer, formerly connected with the Navy department as engineer in charge of construction contracts at Moffett Field, has joined the San Francisco staff of the advertising firm of Wank and Wank. His duties are to direct industrial advertising and marketing for the organization. Shafer was founder of the San Francisco office of McCarty Co., which he managed for over ten years.

» «

W. S. Mounce, formerly senior metallurgist with the Hamilton Standard Propellers Division, United Aircraft Corp., East Hartford, Conn., has joined the development and research division of the International Nickel Co., Inc. He will make his headquarters at the New England technical section of the division, 75 Pearl St., Hartford, Conn.

» «

Irving F. Wagner, formerly manager of American Brake Shoe's Kellogg plant at Rochester, N. Y., has been made a vice-president of the Kellogg Division. Mr. Wagner has been associated with Brake Shoe since 1923 and during the war he was contracts officer.

"TWO-TONE"

Alloys Reduce Maintenance Cost

by Reducing Down Time of Equipment When Repairing

CRUSHER MANTLE REBUILDING

Manganese Crusher Cone, three feet by two feet in diameters, five feet high, rebuilt by applying swedged nickel manganese applicator bars first tacked in place by using coated nickel manganese electrode, then welded down and space between bars completely filled by the "TWO-TONE" PROCESS, using MANGA-TONE N.M. FILLER RODS and AWS 6010 electrode. Final finishing was accomplished by applying a single pass of ¼" ISOROD SELF-HARDENING for additional wear resistance.

RESULT: Productive life trebled and output increased several times more than the original cone.

WORN AND HARD-SURFACED CRUSHER LINER-SEGMENTS

The left hand cut illustrates a liner segment (one of several) surrounding the crusher cone pictured above. NOTE the barely discernible lines indicating previous buildup. Right hand cut illustrates another segment after building up with ¼" DIA. ISOROD SELF-HARDENING. Pinholes are only on surface and caused by floating particles of imbedded crushed rock to surface. They do not extend into deposited metal. PREVIOUS ISOROD DEPOSIT WAS NOT WASHED OFF.

Result of hard-facing: Life of segments increased three times over that of new unfaced segments. Output increased many times with better control of fines. Labor savings by eliminating the changing of segments is a considerable item, also.

BULLETIN NO. 7 EXPLAINS "TWO-TONE" PROCESS

ASK FOR A COPY

RESISTO-LOY CO., GRAND RAPIDS 7, MICHIGAN

Horace A. Deane, formerly works manager of the Brake Shoe and Castings Division of American Brake Shoe Co., New York, has been appointed vice-president of the division.

» «

E. A. Goddard, general manager, Goddard and Goddard Co., Detroit, was elected president and **R. G. Michell,** president, Eclipse Counterbore Co., was elected vice-president of the Cutting Tool Manufacturers Association at the organization's second annual meeting. **R. H. Wolfe,** president, Arrow Tool and Reamer Co., was re-elected treasurer, while **Harry J. Merrick** continues as executive secretary. Elected as new directors to serve for three years were: **L. C. Gorham,** president, Gorham Tool Co., Detroit; **E. C. Putnam,** president Putnam Tool Co., Detroit; **E. F. Reinhart,** president, Republic Drill and Tool Co., Chicago, and **R. H. Wolfe.**

» «

Robert G. Allen has been appointed sales manager of the Baldwin Locomotive Works.

» «

Fred T. Wiggins succeeds **Oscar H. D. Rohwer** as vice-president of Universal Atlas Cement Co., Chicago. Mr. Wiggins was formerly sales manager at Birmingham and more recently assistant to the vice-president in New York.

» «

Newton O. Holt, has been appointed senior contracting manager of the Chicago district of the American Bridge Co., U. S. Steel Corp. subsidiary. He succeeds **Walter G. Zimmermann,** retired. Mr. Holt has been district contracting manager in Chicago since 1926. Mr. Zimmermann retires after having served since 1931 as senior contracting manager.

» «

Orville F. Figley, formerly assistant manager of sales, Chicago district, United States Steel Supply Co., becomes sales manager succeeding **Andrew Verschuur,** retired. **Walter P. Maguire,** formerly sales manager in the Philadelphia office has been made district plant manager succeeding **James B. McIntyre,** retired, **George R. Jones, Jr.,** will succeed Mr. Maguire in the Philadelphia sales office.

» «

Ralph A. Powers, formerly with the Bundy Tubing Co., Detroit, has been named engineer-in-charge of electronic engineering at the Allis-Chalmers Manufacturing Co., Milwaukee. Mr. Powers holds numerous patents on electronic devices and has prepared more than a score of technical papers for trade groups and publications. One of his several inventions is the basic light beam, which provides means of measuring, grading and sorting such metal items as piston pins.

» «

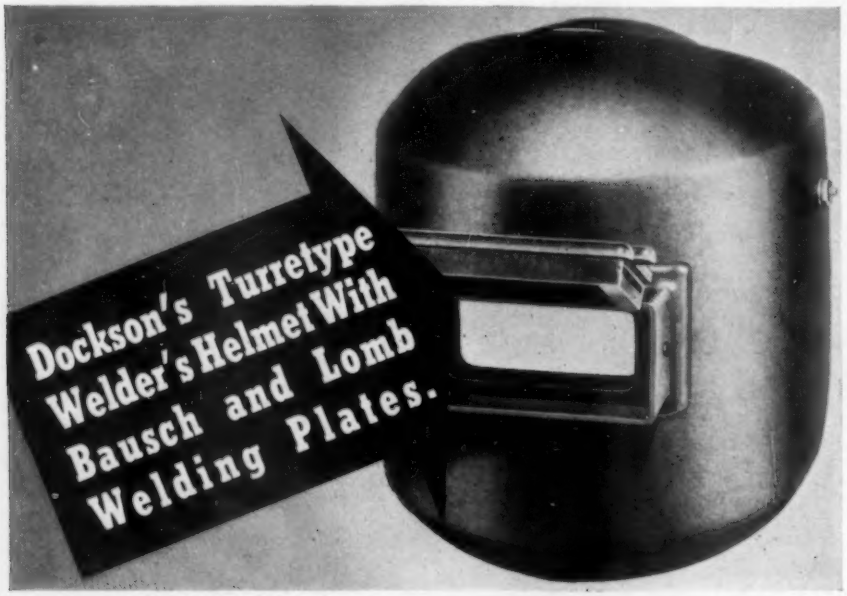
E. R. Nary, who has been associated with Westinghouse Electric Corp. for three decades, has been appointed assistant to Vice-President **Walter Evans.** Mr. Nary's responsibilities will center around operations of the industrial electronics and X-ray divisions at Baltimore, and the home radio division at Sunbury, Pa.

» «

John R. Johnston has been appointed manager of the Milwaukee district sales office, Carnegie-Illinois Steel Corp. He was formerly assistant manager of the Chicago district sales office, a position that will now be taken by **John H. Morava,** formerly assistant to manager of sales. Mr. Morava rejoins the steel corporation after his separation from the United States Army, where he served as lieutenant colonel in the 309th Engineering Battalion. **Howard J. Mullin,** formerly assistant to the Detroit district sales manager, has been made assistant manager of the St. Louis district sales office.

» «

Oscar W. Dauber, 224 South Michigan Ave., Chicago, has been elected president of The Chicago Association of Consulting Engineers.



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DOCKSON TURRETYPE HELMETS are recognized throughout the trade as the finest in light, sturdy, rivetless construction. Moulded from one seamless sheet of heavy, shock-proof fibre these helmets are the last word for comfort, safety and long years of service. They are available with DOCKSON standard headgear, or with the famous, quick adjusting "Number Four" headgear at small additional cost.

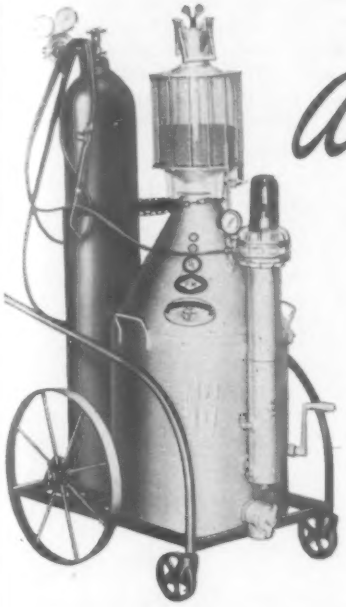
ALL DOCKSON TURRETYPE HELMETS are equipped with scientifically correct BAUSCH & LOMB Welders plates—not just colored glass but scientifically compounded flawless plates which offer the utmost in protection against harmful rays.

The Model 1450 Helmet above is only one item in Dockson's fine line of Better Built Welding and Safety Equipment. *Write for our complete catalog and prices.*

Built for Better Service

DOCKSON CORPORATION

3839 Wabash • Detroit 8, Mich.



As simple as A B C

ACETYLENE costs are 50% to 75% lower, when you own a SIGHT FEED Acetylene Generator. You put the "bottler's" profit in YOUR pocket.

BETTER welds are possible, due to the purer, hotter acetylene which is generated by your SIGHT FEED. A high factor of safety, yet simplicity of operation, is also attained by these generators.

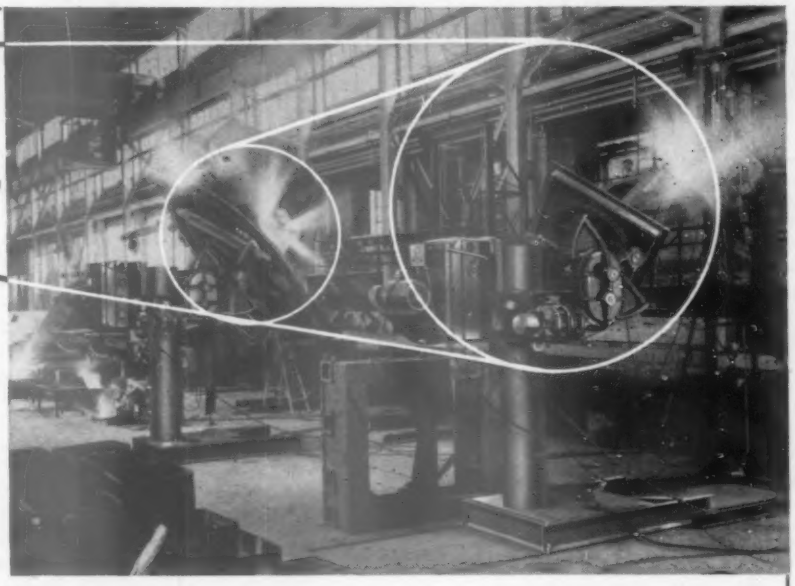
CARBIDE is entirely visible in the SIGHT FEED hopper. You KNOW, before you start a job, how much acetylene you may expect from your present charge.

WELDING *Sight Feed* EQUIPMENT

THE SIGHT FEED GENERATOR CO.

SALES: RICHMOND, INDIANA • FACTORY: W. ALEXANDRIA, OHIO

More WELDING going on here.....



• More welding and less time spent in flopping, propping up and crawling around weldments is the end result of the C-F Positioners in this welding department.

Mounted on C-F Welding Positioners, weldments can be quickly brought into position for a downhand pass—better, more uniform welds with resulting economies and production increases follow. Weldors spend more time welding when they work with C-F Positioners because one "set-up" on the table allows them to maneuver the job, without assistance, whether hand or power operated Positioners are used.

Power operated, variable speed C-F Positioners, with table rotation speeds in any range from 0 RPM and up, coupled with table tilt to 135° from the horizontal make them the logical choice for any production welding operation. Like all C-F Positioners, they have drilled tables for easy set-ups or tables can be quickly removed for installation of special fixtures jigs. Write for Bulletin WP 22. CULLEN-FRIESTEDT CO., 1309 S. Kilbourn Ave., Chicago 23, Ill.

C-F positioned welds mean better, more economical welds

CULLEN-FRIESTEDT CO., CHICAGO 23, ILL.

John H. Giroux, joins THE WELDING ENGINEER as assistant editor after two and a half years with the Army. The majority of his time in the service was spent in Europe, in charge of an artillery section. Before the war, Mr. Giroux attended St. Ambrose College and the University of De Paul.

» «

C. Q. Wright has returned to the Whiting Corp., Harvey, Ill., in the capacity of vice-president dealing with special staff work. Capt. Wright served as a submarine commander in World War II, and has behind him a long, brilliant record of naval service starting in 1911. He came to Whiting in 1939 and was vice-president in charge of sales until he left to rejoin the Navy shortly after Pearl Harbor.

» «

G. A. Huggins, formerly chief of tooling for all Douglas Aircraft plants, and later plant manager of the Douglas Long Beach factory, has been appointed manager of the company's Santa Monica plant. Mr. Huggins succeeds **H. E. Guerin,** who retires after 25 years of service.

» «

Frank C. Kardevan, has been appointed assistant sales manager of Lukenweld, Inc., a subsidiary of Lukens Steel Co., Coatesville, Pa.

A. W. Kremser, has been appointed branch manager of the Davenport, Ia., office of the Allis-Chalmers Manufacturing Co. Mr. Kremser has been with the company since 1924 and was formerly connected with the Chicago office as field engineer. He succeeds **C. J. Schutty,** who is being transferred to the company's Kansas City office.

» «

Colonel Clarence E. Davies, of New York, has been awarded the medal of the Legion of Merit for meritorious service while on active duty with the Ordnance Department of the United States Army. Colonel Davies is secretary of The American Society of Mechanical Engineers, and he is now resuming his duties after an extended leave of absence. He has been with the engineering society since 1920 and since 1934 has been national secretary.

» «

Dr. W. A. LaLande, Jr., formerly director of research of the Attapulgus Clay Co., has been appointed director of the Whitemarsh research laboratories of the Pennsylvania Salt Mfg. Co., Philadelphia.

» «

Dr. Richard J. Lund, formerly director of the miscellaneous minerals division, War Production Board, has joined the staff of Battelle Memorial Institute, Columbus, O. Prior to his three-year association with WPB, Dr. Lund served as consultant on miscellaneous minerals to the old office of Production Management and Defense Commission. Earlier he was editor of the *Mining Congress Journal.*

» «

Louis W. Kempf, assistant director of research, Aluminum Co. of America, has been elected chairman of the Institute of Metal Division of the American Institute of Mining and Metallurgical Engineers, New York City. A recognized authority on aluminum alloys and processes for their application, Mr. Kempf came to Alcoa in 1924, after receiving his degrees at the University of Michigan.

» «

Max L. Murdock, has returned to the Allis-Chalmers Manufacturing Co., Milwaukee, as assistant manager of the centrifugal pump section at the firm's Norwood, O., works. Lt. Commander Murdock served the last three of his four-and-one-half years service on the escort carrier *Altamaha.*

» «

J. Milnor Roberts, Jr., former major in the United States Army and prior to that sales engineer in Detroit for one of the leading carbide tool manufacturers, has been appointed sales manager of the Sykes Advertising Agency, Pittsburgh.

ru'tile, 1. rū'til, 2. ry'til, n. Mineral. An adamantive, reddish-brown, transparent to opaque tetragonal titanium dioxid (TiO_2), usually containing a small quantity of iron (F., shining, L. rutilus, red) ru'til.

SYNONYM

Ruflux

TAMCO is . . . and has been for a number of years . . . the largest supplier of titanium compounds used in welding rod formulation, such as rutile, potassium and sodium titanate. We also furnish alloys such as 40% low carbon ferro titanium, nickel and manganese titanium and compounds such as zircon, potassium zirconate, zirconium oxide, etc., for special coating formulation. Manufacturing operations covering these compounds are carefully controlled, and uniform products are assured at all times.

1. Ruflux 61—A 93% to 95% TiO_2 containing rutile milled to from 0.5% to 1½% on a 200 mesh screen. Major impurities are SiO_2, $ZrSiO_4$, Fe_2O_3 and FeO. Injurious impurities such as S. and P_2O_5 are kept to a minimum.

2. Ruflux 84—A 93% to 95% TiO_2 containing granular rutile of similar analysis to Ruflux 61. This coarser rutile is used to avoid coating dry cracking.

3. Ruflux P—A potassium titanate containing approximately 73% TiO_2 and 19% K_2O. This compound is used for arc stabilization purposes and contains no injurious impurities. Ruflux P is milled to approximately 4% on a 200 mesh screen.

4. Ruflux S—A sodium titanate containing approximately 80% TiO_2 and 15% Na_2O. Another arc stabilizer and formulated to reduce hycroscopic action to a minimum.

5. Ruflux Z—A zirconium silicate containing approximately 65% ZrO_2 and 34% SiO_2 combined as $ZrSiO_4$. The compound is milled to 0.10% on a 325 mesh screen and due to its high melting point (3850° F.) is used as a slag stiffener.

6. Ruflux P. Z.—A potassium zirconate, containing 80% to 81% ZrO_2, 14% to 15% K_2O, 3% to 4% SiO_2 and smaller percentages of TiO_2, Fe_2O_3, CaO, etc.

7. Ruflux T—A zirconium oxide containing from 90% to 91% ZrO_2, 5.00% SiO_2, 0.80% Na_2O and lesser percentages of TiO_2, CaO, Al_2O_3, etc. Ruflux T is milled to 0.1% on a 325 mesh screen.

8. 40% Low Carbon Ferro Titanium—containing from 38% to 42% Ti., 3% to 5% Si., 6% to 9% Al., 1% to 2% Cr. The alloy is milled to minus 80 mesh.

9. Tam Nickel Titanium—contains from 25% to 28% Ti., 60% to 65% Ni., 6 to 8% Al., 2% to 4% Si., and 2% to 5% Fe. The alloy is milled to minus 80 mesh.

10. Tam Manganese Titanium—contains from 27% to 29% Ti., 35% to 40% Mn., 20% to 25% Fe., 7% to 9% Al and 2% to 4% Si. The alloy is milled to 80 mesh.

Tamco also manufactures alloys such as Ferro Carbon Titanium, Bortam and boron containing titanium alloys, and various other titanium and zirconium compounds.

It pays to include these compounds in your welding rod coating formulation research.

A reasonable series of tests in your own plant will indicate the superiority of RUFLUX.

THE TITANIUM ALLOY MANUFACTURING CO.

Executive Offices: 111 BROADWAY, NEW YORK, N. Y. *General Offices and Works:* NIAGARA FALLS, N. Y.

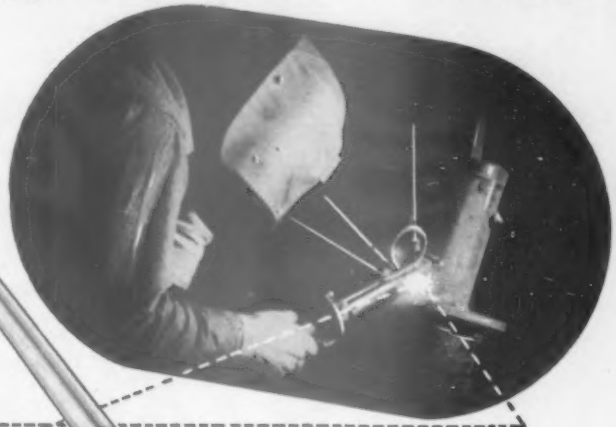
Callite PURETUNG electrodes 99.9% PURE TUNGSTEN

99% PURE TUNGSTEN WELDING ELECTRODES

Speed fabricating and repairing by atomic hydrogen process —

Slowly consumed—they are economical to use

Especially efficient for hard-to-weld metals



Callite

CALLITE TUNGSTEN CT

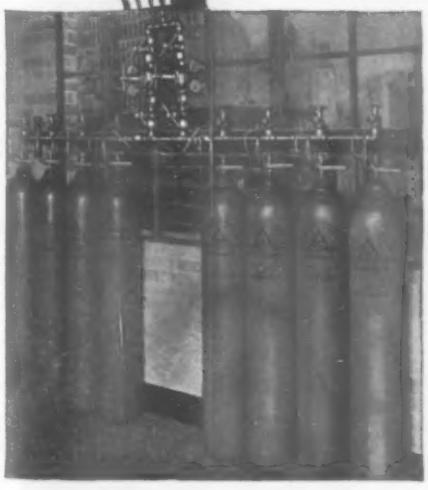
PURETUNG ELECTRODES

Standard and special-polished, clean and black. 7 standard diameters; 12-inch lengths. Random lengths and other diameters on special order.

If you are welding aluminum, duraluminum, nickel, chrome, molybdenum steels, copper, stainless steel, brass or bronze—Callite Puretung Electrodes will save you time and money. Well-known aircraft and machine tool manufacturers have found that Puretung Electrodes last longer—reduce grinding and finishing. Investigate their many advantages. Callite Tungsten Corp., 549 Thirty-ninth Street, Union City, New Jersey. Branch Offices: Chicago, Cleveland.

OVER 26 YEARS PIONEERS IN TUNGSTEN METALLURGY

Are YOUR WELDING OPERATIONS LIKE A TRAFFIC LIGHT?



● You can eliminate costly "Stop-Go, Stop-Go" operations in your shop by installing the RegO Manifold designed for your requirements.

You not only gain the advantage of uninterrupted operations, but also save valuable production space and eliminate hazards, time and trouble caused by wheeling full and empty clinders through a busy department.

Learn about *all* the advantages you can get with RegO Manifolds . . . there's no obligation . . . write today!

REGO ARMY E NAVY

The BASTIAN-BLESSING Company

4239 Peterson Ave. • Chicago 30, Ill.

Pioneers and Leaders in Equipment for Using and Controlling High Pressure Gases

ELECTRODES *for* PRODUCTION WELDING!

AGILE-GREY is a fast working sheet metal electrode that has excellent fluidity and *will not burn through.*

AGILE-BLUE is an all-position electrode designed especially for low open circuit A. C. transformer type welding machines.

AGILE ACTARC

AMERICAN AGILE CORPORATION
5806 HOUGH AVENUE
CLEVELAND 3, OHIO

John P. Clark, has been appointed sales engineer of The Ajax Electric Co., Philadelphia. His district will cover eastern Pennsylvania, southern New Jersey, Maryland, District of Columbia, Virginia and North Carolina.

» «

Arthur D. Beers, formerly assistant superintendent of the central mills of the Gary steel works, Carnegie-Illinois Steel Corp., has been promoted to the superintendency, succeeding **J. C. Wilkins,** retired. **David L. Simpson,** formerly assistant chief metallurgist of the plant, has been made superintendent of the 12-1 and 12-2 merchant mills, succeeding **William Lange,** resigned. **Lester R. Pearson,** formerly assistant to superintendent of the Gary works roll shop has been made superintendent, succeeding **Robert S. McCleery,** retired.

» «

Fred J. Woodburn, has been appointed manager of pig iron sales of the American Steel and Wire Co., subsidiary of U. S. Steel Corp., **G. W. Crowl** has been named assistant manager. Mr. Woodburn has been associated with the iron and steel industry since 1913. Mr. Crowl started in the industry in 1908, when he began selling pig iron in Pittsburgh.

» «

Paul L. Lindsay, has been named general staff manager, sales, of the American Steel and Wire Co. In addition to his other duties he will assume the responsibilities of **V. H. Farr,** former assistant general manager of sales, retired.

» «

Thomas C. Ford, has been appointed district manager of the Pittsburgh office of Electro Metallurgical Sales Corp., unit of Union Carbide and Carbon Corp., New York. In 1936 Mr. Ford became a service metallurgist of Electro Metallurgical Co., and he has since been associated with the company offices in Pittsburgh, Birmingham and Chicago.

» «

Dr. Stewart G. Fletcher, formerly research associate at Massachusetts Institute of Technology, is now chief research metallurgist for Latrobe Electric Steel Co., Latrobe, Pa. Dr. Fletcher will head an expanded metallurgical research department for continued research in all phases of high-speed steel, tool-steel and die-steel production.

Died . . .

Harry Butler, president of the Welding Equipment and Supply Co., died December 31, 1945.

» «

E. A. Balsley, a welding consultant, died at Williamsport, Pa., on December 22. Mr. Balsley, an old-timer in the welding field, was for many years a welding engineer with Link-Belt Co. He was at one time chairman of the Chicago section of the American Welding Society.

Dollars can't be made this way . . . but there's money in using

COLONIAL GLOVE AND GARMENT SPLITS

Welders demand their combination of greater comfort, safety, and durability. Available in all weights for men's and women's gloves and garments in large spread whole kips and side splits. Write for samples.

COLONIAL TANNING CO.
Glove and Garment Leather Division
MILWAUKEE, WIS.

W-AL-CO RODS
for Welding of ALUMINUM
ELECTRIC AND GAS WELDING

Drawn Wire
Types 25, 43 and 52
Brazing **716** (low Melting)

FOR CAST ALUMINUM
Use Extruded Rods
Types 142, 195, 355 and 356
for Better Welding
3/16" size only

WELDING ALLOYS MANUFACTURING CO.
744 Broad St., Newark 2, N. J.

2 new GREYHOUND

FARM and SERVICE STATION PORTABLE A. C. WELDERS

Built-in Capacitor for High Power Factor Correction — Meets R.E.A. Requirements — Also Reduces Power Bills and Installation Costs

Model N115 Exterior View

☆ ☆

Model N115—Has a New Power Packed Multiple-Coil Transformer, Features 4 Coils Instead of 2. Also Separate Reactance, Double-Woven Spun-Glass Insulated Magnet Wire. 15 to 115 Amperes.

Model N115 Interior View

MODEL NF180 — Has the Same Transformer as our World Famous Variable Core Type Heavy-Duty Industrial Models with Handwheel Stepless Amperage Control. Double-Woven Spun-Glass Insulated Magnet Wire. 20 to 180 Amperes.

Write for Details — **ALSO HEAVY-DUTY INDUSTRIAL MODELS**
Territories Available for Distributors

GREYHOUND A. C. ARC WELDER CORP.
Manufacturers
520-28 Morgan Ave., Brooklyn 22, N. Y.

LIVE LINE CLAMPS

Make Hi-Pressure,
electrically and mechanically solid contact. Used extensively on live overhead power lines for—

- Cutting out a section of line for repairs
- Grounding circuit or feed lines
- Temporary feed lines
- Isolating equipment

Other clamps are — connectors, terminals, taps, etc.

RAILWAY AND INDUSTRIAL ENGINEERING CO
KERR STREET . . . GREENSBURG, PENNSYLVANIA

For more Difficult Jobs

Cleve-Tung **POLISHED TUNGSTEN ELECTRODES**

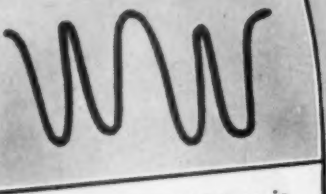
CLEVE-TUNG pure tungsten rod for atomic hydrogen and heliarc processes can be furnished in a range of lengths to meet your specifications. Very close tolerances, low surface resistance and extreme purity are attained by polishing. Spectroscopic control further safeguards purity.

Also CLETALOY ELECTRODES for Spot Welding

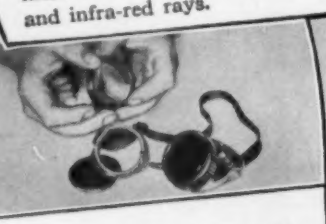
Cletaloy Electrodes for spot welding are available in four hardnesses. A copper- or silver-tungsten material developed by us, it insures superior results under conditions where hardness, rigidity and high conductivity are essentials.

CLEVELAND TUNGSTEN, INC.
10201 MEECH AVENUE . CLEVELAND, OHIO

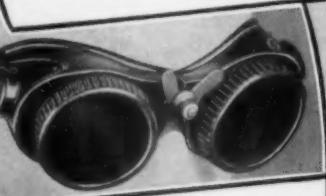
Get This Assurance of Welding Eye Protection



Every Willson-Weld lens is marked like this. Purpose: to show that it meets highest Federal specifications. Reduces intensity of visible light, filters out harmful ultra-violet and infra-red rays.



Clear cover lenses to protect green Willson-Weld lenses from pitting. Both lenses easily replaceable. Welding goggles fit comfortably over ordinary correction spectacles.



Style CW-60

Shade number — determined by individual photometer test —indicates density and thickness of each lens. Simplifies selection. Lenses easily interchanged for different types of welding.

For help with your welding eye-protection problems, consult your Willson distributor or write for further information.

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Helpful Literature Just Published

The following reviews are of recent publications of interest to those in the welding industry. Unless otherwise stated, they may be obtained without cost by writing to the manufacturers listed.

Fabrication Manual

"Tailoring in Metal" is the title of a new engineering manual designed to help engineers and designers decide whether or not fabrication by welding and the materials made available by this method are applicable to their particular problems. It discusses the factors involved in the decision: cost, weight, strength, appearance, stability, noise, quality and delivery.

Information is given on how various types of welds affect static and fatigue load values. Of particular interest to the designer is the specific information given about devices which can be employed to reduce cost and improve construction.

Although this manual was written primarily for manufacturers of machinery and heavy equipment, it should interest those involved in shop maintenance because of the application of welding to such fabrications as gear blanks, pulleys, tanks, casings, housings, frames, breechings, stacks, etc. The methods described are illustrated with both drawings and photographs. **The United Welding Co.**, 1482 Lafayette St., Middletown, O.

» «

"Hastelloy" Folder

A four-page, letterhead-size folder, "Hastelloy Facing for Corrosion Resistance," describes a new process developed to protect chemical-plant and oil-refinery equipment from corrosion by facing such equipment with the Haynes nickel-base alloy, "Hastelloy." The alloy is, of course, applied only to the particular surfaces that are exposed to corrosive agents. Welding rods are used to cover relatively small areas with corrosion-resistant deposits, and thin sheets of the alloy are welded in place as a protective lining for large areas. The details of both of these methods are given in the folder, which also furnishes data on the various grades of "Hastelloy" available and the corrosive media they will resist.

Among the parts that can be faced with welded deposits of this alloy are: valve bodies, seating surfaces and stems; large pipe elbows; agitator blades and shafts; mixer arms; tank outlets; pump parts; large hose couplings; flanges. The equipment that is best faced by lining with "Hastelloy" sheet or plate includes reaction vessels of all types, autoclaves, tanks and receivers from 100-gal capacity upwards. Four different welding procedures are being used to do this work—plug welding, strip welding, resistance welding and lap welding. Haynes **Stellite Co.**, Kokomo, Ind.

» «

Weld-Nut Data Sheet

Data Sheet 7-45-2M from Ohio Nut & Bolt Co. gives all of the production sizes of Ohio flanged weld nuts for projection welding. This type of nut is made with both round and tee flanges and with round and square bodies (square body is made in one size only, to facilitate production). The height of the flange will be found to be only slightly greater than the thickness of the sheet steel to which the nuts are to be projection welded, and this simplifies the set-up for the welding operation and reduces the amount of current required, states manufacturer. **The Ohio Nut & Bolt Co.**, 600 Front St., Berea, O.

» «

Folder on Heat Treating

An eight-page, letterhead-size folder gives interesting information on the various heat-treating services being offered by Lukens. These include: stress relieving carbon and alloy steel plates, heads, shapes and weldments; annealing to relieve stresses, induce softness, improve ductility and refine grain structure; normalizing to adjust and refine grain structure and bring about greater uniformity of physical properties; spheroidizing to produce maximum softness for machining and deep drawing by developing a globular form of carbide; hardening over a wide Brinell range; tempering to relieve the strains induced by the hardening process. Other auxiliary services are also mentioned, including heat treating stainless steels, grit and sand blasting, straightening and flattening within close tolerances, photomicrographic examination to analyze grain structure, X-ray and magnetic-particle inspection, pickling, painting and oil treating. **Lukens Steel Co.**, 281 Lukens Bldg., Coatesville, Pa.

» «

Folder on Foundry Grinding

A six-page, letterhead-size folder has been published to cover the uses and applications of the Norton B-5 resinoid wheel for foundry grinding. This type of wheel may be used on either portable or swing-frame grinders for cleaning-up operations on steel, gray iron, malleable iron, brass, magnesium and aluminum castings. **Norton Co.**, Worcester 6.

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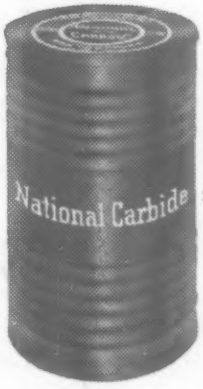

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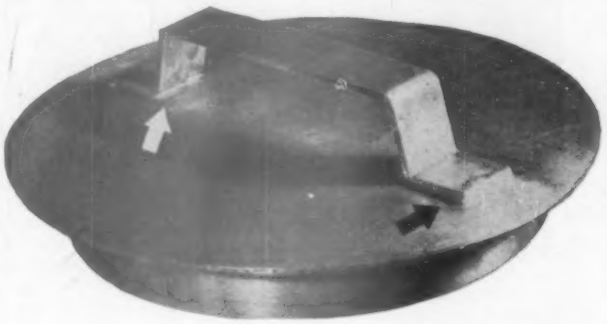


KRE-CO ALUMINUM BRAZING PROCESS SOLVES PROBLEMS

The joining of aluminum sometimes creates difficulties. The KRE-CO ALUMINUM BRAZING PROCESS overcomes intricate problems. Bulletin "F" contains valuable information for fabrication of aluminum. Yours for the asking.

KRE-CO MULTICHEMIC FLUX
DIVISION OF
CHARLES W. KRIEG CO.
52-60 Dickerson St. Newark 4, N.J.

X-Ray Catalog

A 12-page, letterhead-size catalog in two colors is devoted to "Norelco" industrial X-ray equipment for fluoroscopy, radiography, diffraction and spectrometry. The equipment includes two stationary X-ray units with maximum voltages of 150 and 80 kvp, a conveyor-type unit with a maximum of 150 kvp and a mobile unit with a maximum of 90 kvp. The final two pages of the booklet are given over to an "Application Selector Chart" in which X-ray inspection uses and suggested "Searchray" units are given for airplane parts, assemblies, batteries, cable, castings, ceramics, foods, plastics, rubber products, steel, electronic tubes and welds. **North American Philips Co., Inc.**, 100 East 42nd St., New York City 17.

» «

Tensile-Testing Bulletin

Dillon Bulletin No. 142, an eight-page, letterhead-size booklet in two colors, describes the construction and operation of a portable universal testing unit which may be used for tensile, compression or shear tests of welded specimens. A girl operator can apply tension up to 10,000 lb (maximum) by means of the counterbalanced handwheel, the bulletin states. **W. C. Dillon & Co.**, 5410 West Harrison St., Chicago 44.

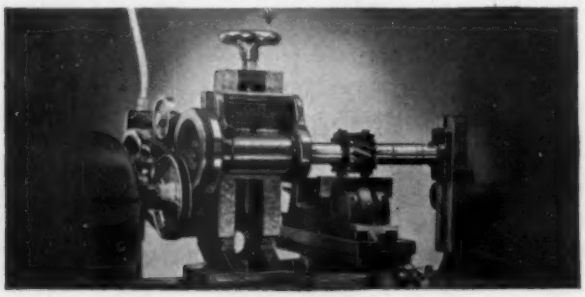
New Unit Makes Milling Machine Out of Lathe in 3 Minutes!

The Globe Miller, a unit quickly attached to a standard lathe, performs the same operations as a costly milling machine. Installed in 3 minutes or less, the Globe Miller operates almost identically to a standard milling machine. All controls are simple, highly accurate—and the miller is designed to utilize all speeds and feeds of the lathe.

It is accurate, durable and highly versatile. With minor adjustments and accessories, the miller will face castings; cut slots, keyways, and gears; perform slitting operations, etc. Quality materials and rugged construction enable it to stand the hardest use. It costs but a fraction as much as a standard miller. Its compact design makes storage possible underneath the lathe. Proved performance in wartime production, assures dependable service.

Performance has also proved that chewing gum helps you on the job—by seeming to make work go easier, time go faster. Today, you'll see good chewing gum on the market. But a shortage still exists. Wrigley's Spearmint Gum is taking this space for your information, and for now, we'd like to suggest that you use any good available brand. Remember: It's the chewing that's good for you.

You can get complete information from Globe Products Mfg. Co., 3380 Robertson Boulevard Los Angeles 34, California



AA-55

Safety Equipment Catalog

The new 178-page "6-B" catalog issued by Mine Safety Appliances describes and illustrates the complete range of M.S.A. safety equipment for industry, including several new products. The regular edition of this catalog is in its usual letterhead-size, but there is also a pocket-size edition measuring 5 by 6½ in. The pocket edition contains the same material and number of pages as the large edition but all in miniature. **Mine Safety Appliances Co.**, Braddock, Thomas and Meade Sts., Pittsburgh 8.

» «

Welded Crane Folder

A six-page, two-color folder describes the 40-ft "Tournacrane" and pictures various applications ranging from the installation of oil-storage tanks to the placing of culverts. Like all equipment manufactured by LeTourneau, the "Tournacrane" is a welded product. **R. G. LeTourneau, Inc.**, Peoria, Ill.

» «

News Letter

"Spatter," a monthly news letter circulated by the National Welding Supply Association, is available free of charge to distributors of welding equipment and supplies. Requests should be addressed to the **National Welding Supply Association,** 324 East Second St., Dayton 2, O.

» «

Special Machinery Catalog

A new catalog in five sections illustrates types of the special machinery built to customers' designs and specifications by the contract division of **Thomas Machine Mfg. Co.**, Pittsburgh 23.

» «

Marking-Equipment Catalog

A 36-page, letterhead-size catalog describes the complete line of Acme equipment for metal marking. It includes more than 150 different products in the marking field. The catalog is profusely illustrated and is featured by a thumb index in the front and back. By placing a thumb opposite the listing in the index, the reader is guided to the proper portion of the book by imprints on each page. **Acme Marking Equipment Co.**, 2222 West Fort St., Detroit 16.

» «

Electrode Catalog

A 16-page, two-color booklet, 4 by 9 in., describes the physical and chemical properties of "Edco Yellow-Shielded" phosphor-bronze electrodes. These are coated electrodes which can be used to arc weld copper, bronze or cast iron. Detailed procedures for the welding of each of these metals, including preparation, polarity, voltage and amperage settings, etc., make the booklet useful reference material for the weldor and the shop man. **Eccles & Davies,** 1910 Santa Fe Ave., Los Angeles 21.

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Dieweld Gives Added Life to Clutch on Rolling Mill Shear

The illustrations show how Amsco Dieweld was effectively employed in building up worn dogs on a rolling mill shear clutch. Picture A-489 illustrates a clutch as worn, and another that has been rebuilt with Dieweld. In Picture A-490, the welder is dressing up the built-up clutch dogs with a portable grinder. The convenient jig for holding the clutch in accessible working position is shown in both pictures.

As Amsco Dieweld offers excellent resistance to shock, and the deposit as welded has a hardness of between 500 and 600 Brinell, it gives a good account of itself not only on the clutch dogs—in terms of added service life—but on the knives of the shear as well.

Dieweld has an infinite variety of uses in every maintenance shop, tool room and die shop, where metallic arc, oxy-acetylene or atomic hydrogen welding is done. It finds excellent application in the production and alteration of composite hot and cold forming dies, hot trim dies and punches, shear knives and cutting tools, and for the restoration of such parts when they become worn. The deposited metal has hardness combined with unusual toughness, and the ability to retain keen cutting edges and resist wear and abrasion in both hot and cold work.

Amsco Dieweld is an alloy containing chromium, molybdenum, silicon and carbon; providing a weld metal which is air-hardening as deposited, and which may be softened through proper heat treatment for machinability and re-hardened within a desirable range.

Dieweld is one of the group of Amsco welding materials for the reclamation, hard surfacing and repair of ferrous equipment parts. Details in Bulletin No. 742W on Amsco Dieweld.

(Amsco Welding Products are produced and sold in Canada by Canadian Ramapo Iron Works, Inc., Niagara Falls, Ontario.)

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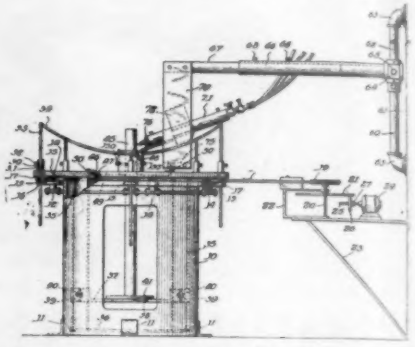
FROM THE PATENT OFFICE

Pipe-Cutting Machine

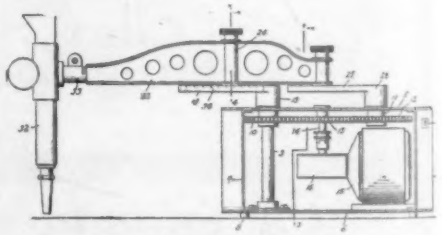
2,389,463. **Michael C. Smotzer**, Oak Park, Ill., assigned to **James B. Clow & Sons**, Chicago. Filed Jan. 24, 1944. Issued Nov. 20, 1945.

The combination with a torch of automatic means for moving and directing



its action with respect to pipe to be processed. A table holds the work and moves it at a predetermined speed past a vertical plane occupied by the torch. A template and a guide of predetermined shape are mounted on and are movable with the table. A holding means confines the torch in a vertical plane while permitting it to slide freely toward and away from the work up and down in the plane and also to oscillate to assume angular positions. The torch is slidably mounted in the holder and is entirely controlled in its movements by the template and guide.

» «



Circle-Cutting Machine

2,390,938. **William F. Hubbell**, Biloxi, Miss. Filed May 22, 1943. Issued Dec. 11, 1945.

A portable circle-cutting machine including a supporting base having spaced upper and lower plates. Vertical shafts are journaled in the upper plate at fixed points, and gears are mounted on these shafts directly below the plate. A motor mounted upon the lower plate is connected to the shafts and drives them at similar speeds in the same direction. Flat, horizontal arms are fixed on the upper ends of the shafts, and upon these rests a horizontal I-beam connecting rod. The outer end of the connecting rod supports the cutting torch in an upright position with its tip in proximity to the sheet from which the circle is to be cut.

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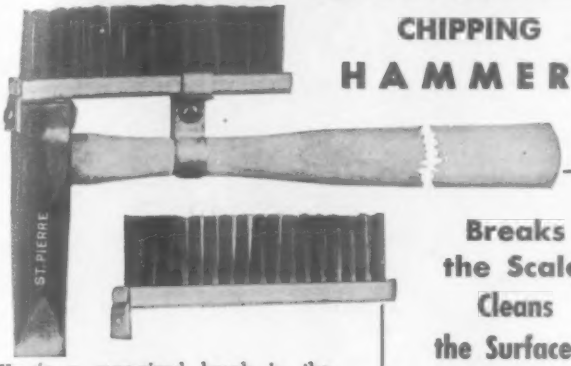

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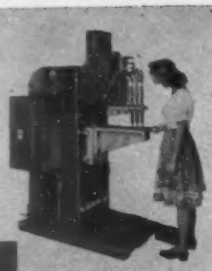

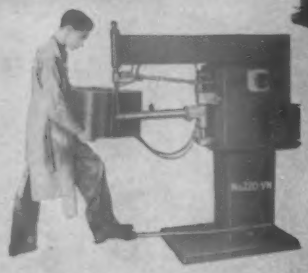

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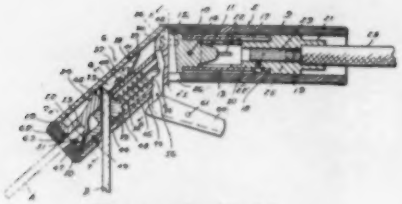


Electrode Holder

2,390,837. **James H. Hill**, Long Beach, Calif., assigned 49% to **Howard F. Craven**, Long Beach, Calif. Filed Aug. 22, 1944. Issued Dec. 11, 1945.

An electrode holder with elongated nose and handle portions disposed at an obtuse angle to each other. Each portion includes a conducting body having an insulating sleeve fitted over it. The inner ends of the body and insulating sleeve of the nose portion are oblique to the longitudinal axes and respectively abut the outer ends of the body and the insulating sleeve of the handle. The adjacent ends of the bodies are rigidly secured together, and the end of a conductor cable is secured to the inner end of the handle portion. The body of the nose portion carries a spring-engaged and trigger-released electrode-clamping means. Clamping element is slidable longitudinally within the nose. The angular trigger has an arm extending into and bearing at its free end against the outer wall of a kerf in the inner end of the nose. A rod projecting rearwardly from the clamping element is pivoted to the intermediate portion of the trigger arm.

Eyeshield

2,389,707. **Joseph Rowland Wylde** and **Richard Gilbert Perry**, Spondon, near Derby England, assigned to **Celanese Corp. of America**, a corporation of Delaware. Filed Dec. 31, 1941. Issued Nov. 27, 1945.

An eyeshield of a width and depth to

cover both temples, both eyes and the area of the face adjacent to the eyes. The body member is a sheet of wire gauze with edges bound by reinforcing wire. A thin sheet of colored plastic is disposed on the inner face of the wire gauze, and the two sheets are secured together. A retaining member is also secured to the body member.

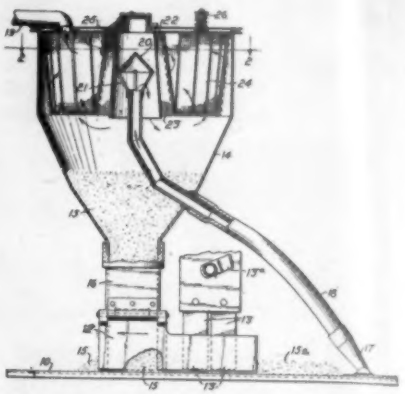
» «

Multiple Spot Welder

2,389,324. **Arthur Pedley**, Bentley, near Walsall, England, assigned to **Rubery Owen & Co., Ltd.**, Darlaston, England. Filed June 10, 1943. Issued Nov. 20, 1945.

A multiple spot-welding machine having a plurality of movable electrodes and a block with bores to slidingly receive them. A rigid current-conducting bar bolted to the block carries spaced plungers coacting with one of the electrodes. A spring urges the plungers to press one electrode into contact with one side of its associated bore to insure good conductivity between bar and electrode.

» «



Submerged-Melt Flux Feed

2,390,560. **Sidney J. Stanley** and Jason **E. Welch, Sr.**, Turtletown, Tenn. Filed May 28, 1943. Issued Dec. 11, 1945.

In a submerged-melt welding apparatus, a feeding means for supplying flux material to the work and a means for retrieving the flux after welding. It includes a closed flux hopper, a gravity-feed pipe leading from the bottom of the hopper to the work, a recovery pipe leading from the work to the top of the hopper, and a means for producing a vacuum within the hopper. Flux material is reclaimed through the recovery pipe without interfering with the feed of flux through the gravity pipe.

» «

Electrode Holder

2,389,559. **Frank R. Smith**, Los Angeles. Filed March 10, 1944. Issued Nov. 20, 1945.

Electrode holder base member and a pivoted lever member having hook-and-pin pivotal connecting means. The hook-carrying member is slidable lengthwise to effect engagement or disengagement of the hook with the pin. The members have electrode-gripping jaws and means to insure engagement of the pivotal connection.

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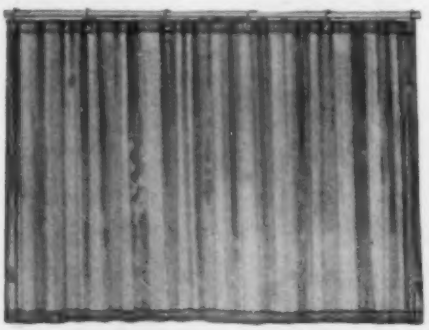

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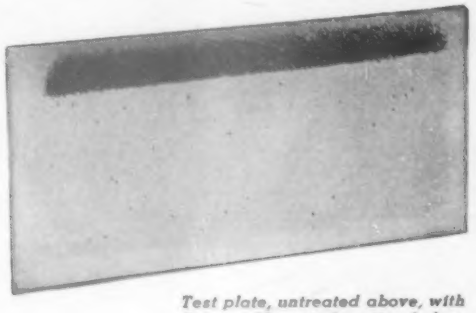

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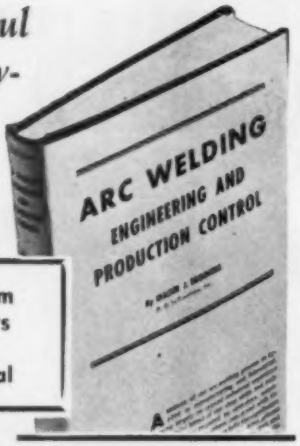

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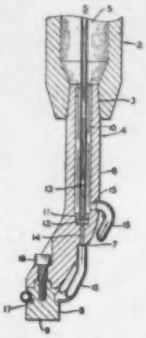
Fluid-Cooled Electrode Tip

2,389,946. **John J. Wisler,** Columbia, Pa., assigned to **Armstrong Cork Co.,** Lancaster, Pa. Filed April 1, 1944. Issued Nov. 27, 1945.



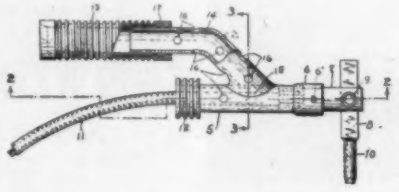
A spot-welding electrode comprising an electrode body and a welding tip that is offset from the vertical axis of the electrode holder. The tip has a contact face which engages the metal to be welded. A conduit for cooling fluid is received within an external groove closely adjacent the contact face. Cooling fluid circulates through the electrode holder into the conduit.

» «

Electrode Holder

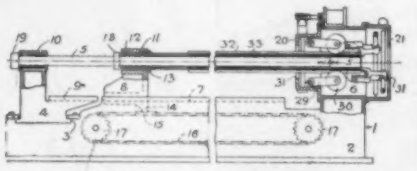
2,389,938. **William E. Smith,** Detroit, assigned to **The Midland Steel Products Co.,** Cleveland. Filed April 5, 1944. Issued Nov. 27, 1945.

An electrode holder having a tubular



body wth a tubular lateral branch extending at an angle thereto. The conductor cable is adapted to extend through the body. The handle is secured to the lateral branch, where it is free of contact with all conductors.

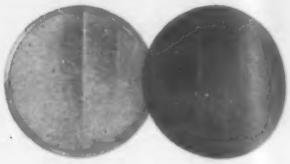
» «



Seam Welder for Fin Tubes

2,390,855. **Norman C. Thompson,** Auburn, N. Y., **Addison Y. Gunter,** Larchmont, **Wilbur A. Shaw,** Forest Hills, and **Walter E. Roe,** deceased, late of Kirkland, N. Y., by **Viola B. Roe,** administratrix, Clinton, N. H., assigned to **American Locomotive Co.,** New York City. Filed March 4, 1944. Issued Dec. 11, 1945.

A machine for seam welding a fin bracket to the external surface of a tube. A mandrel support is mounted at one end of the machine base, and a tube pusher is slidably mounted for longitudinal movement. The mandrel is slidably mounted in the support and pusher. The seam-welding roller is mounted at the other end of the base from the mandrel support. Roller is forced into pressure engagement with the fin bracket while the mandrel supports the tube.



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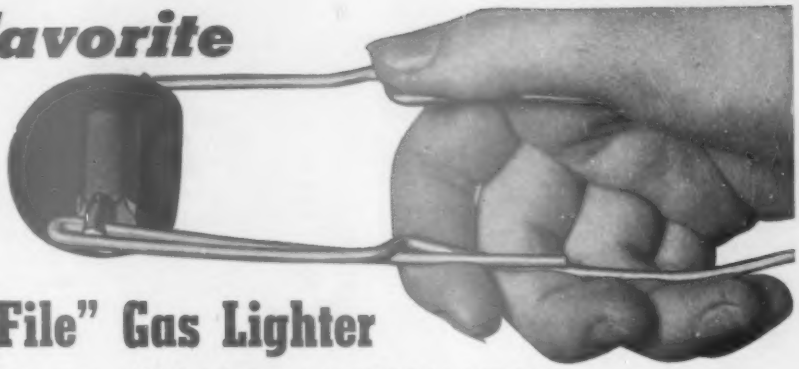

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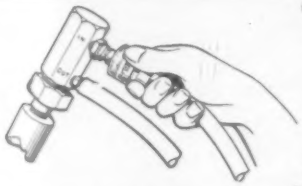

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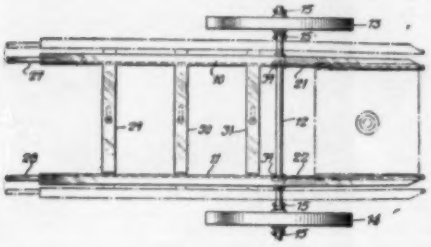
Welded Carboy Truck

2,389,294. **Edward W. Burke,** Mahopac, N. Y., assigned to **Pulmosan Safety Equipment Corp.,** Brooklyn, N. Y. Filed Nov. 13, 1945. Issued Nov. 20, 1945.

A carboy truck which comprises an



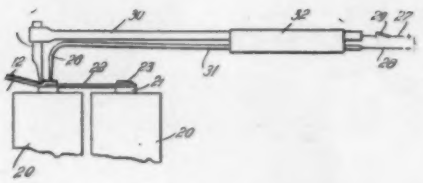
axle, a pair of wheels, a pair of side rails of angle cross-section positioned above and at right angles to the axle. Side rails have downwardly extending flanges which are slit above the axle; the rails are bent upwardly at the slit. A plate is welded to the vertical flanges to form slidable supports for the rails. Cross beams extend between and connect the side rails at one side of the axle; each beam comprises a channel iron welded to the vertical flange of one side rail and extending at a right angle thereto. A plate is welded to and extends at a right angle from the opposite side rail into the space between the flanges of the channel iron, and a plate is welded to the lower edges of the flanges of the channel iron to enclose the first plate. A screw is then threaded through the closing plate.

» «

Spot-Welding Electrode Holder

2,390,936. **Preston M. Hall,** Worcester, Mass. Filed Feb. 29, 1944. Issued Dec. 11, 1945.

The combination of an externally tapered bushing split at its smaller end so as to be compressible about a spot-welding electrode. Holder has a flaring recess shaped to admit and compress the smaller end of the bushing; this recess is too small for the larger portion. The annular flange at the larger end of the bushing is spaced from the adjacent end of the holder to admit a pry between them.

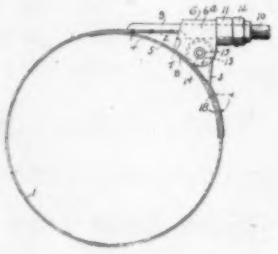


Soldering Method

2,390,890. **Allison M. MacFarland** Freeport, Ill., assigned to **Burgess Battery Co.,** Freeport, Ill. Filed Feb. 4, 1943. Issued Dec. 11, 1945.

A soldering method in which the end of an elongated composite soldering member is placed against the parts to be soldered. The soldering member is composed of an element of metallic solder and a metallic backing element having a cross-sectional area substantially less and a melting point substantially higher than the solder. While the heated end of the soldering member is held against the parts, a different portion of the member may be pulled to cause the heated end to separate from the remainder.

» «



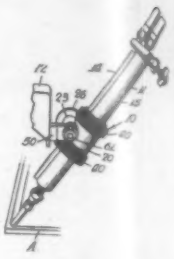
Hose Clamp

2,389,785. **James T. King,** Burbank, Calif. Filed March 9, 1944. Issued Nov. 27, 1945.

Components of this hose clamp are a flexible strap having end portions of reduced width, a threaded bolt secured to one end portion, a U-shaped member through which the bolt passes and an anchoring pin secured in the U-shaped member. The reduced-end portion of the strap which is not secured to the bolt is looped about the anchoring pin. A nut on the threaded bolt at the other end of the strap engages the U-shaped member.

Flame-Cutting Device

2,390,896. **Raymond L. Pelland, Jr.,** Chicago, assigned to **National Cylinder Gas Co.,** Chicago. Filed April 28, 1943. Issued Dec. 11, 1945.



A torch-clamping and adjusting device comprising a sleeve adapted to embrace a torch barrel. The sleeve carries a plurality of circumferentially spaced torch-confining elements which may be moved into engagement with the barrel to center and clamp it. A tubular projection extends tangentially from the sleeve and is connected with a lockable hinge. The sleeve support holding the lockable hinge is mounted to pivot about an axis at right angles to the axis of the hinge connection.

» «

R-W Control System

2,390,744. **Stephen L. Burgwin,** Forest Hills, **John R. Mahoney,** Homewood, and **Harry J. Bichsel,** Wilkinsburg, Pa., assigned to **Westinghouse Electric Corp.,** East Pittsburgh. Filed Nov. 24, 1943. Issued Dec. 11, 1945.

This resistance-welding circuit comprises a capacitor, means for precharging it, and means for effecting discharge of the precharged capacitor in one direction through a predetermined number of turns of the transformer primary. After such discharge, the capacitor is charged inversely, and the discharge is then effected in the opposite direction through a second and greater predetermined number of turns of the primary winding.

» «

Brazing Alloy

2,390,775. **Joseph G. Christ,** Wilkinsburg, Pa., assigned to **Westinghouse Electric Corp.,** East Pittsburgh. Filed March 25, 1944. Issued Dec. 11, 1945.

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